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ABSTRACT

Three fiscal year 1987 deliverables due for the "Toward a National Educational Testing Network: Feasibility Study of Duplex Design" are presented. The study is concerned with implementation of statewide and interstate testing of student attainment. The report includes: (1) a duplex design (DD) review paper discussing the means by which the DD will meet local and state information needs; (2) sample students' score reports from the Illinois pilot implementation of the design; and (3) item parameter estimates (IPEs) and standard errors for sub-skills of the eight second-stage forms of the duplex instrument used in Illinois. The DD review covers educational information needs, uses of attainment information, the combination of student achievement testing and assessment of curricular objectives, the contribution of modern Item Response Theory (IRT), adaptive testing, reporting results, and interstate comparisons. The California Assessment Program is described. The DD proposed supplies achievement scores for individual students in the main areas of proficiency and content, while evaluating the progress of schools in attaining the objectives of the instructional program and curriculum. The DD uses IRT, matrix sampling, and two-stage testing techniques. The IPEs are tabulated on 24 pages. (TJH)

Center for Research on Evaluation, Standards, and Student Testing

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PROJECT: TOWARD A NATIONAL EDUCATIONAL TESTING NETWORK

"Final Report"

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Center for the Study of Evaluation
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INTRODUCTION

This report presents the three FY1987 deliverables due for the Toward a National Educational Testing Network: Feasibility Study of Duplex Design. Included are the following documents:

A. Duplex design review paper discussing topics of how the duplex design will meet local and state information needs; this paper will be published in Evaluation Comment.

B. Sample score reports from the Illinois tryout. These include the student reports, one copy of which was supplied to the teacher and one to each student; the School reports supplied to the school principals and District Superintendents; and State reports provided to District Superintendents and to the Illinois State Board of Education. The three schools represented in these sample reports were drawn from the low, middle and high ability levels of the schools.

C. Item parameter estimates and standard errors for subskills of the eight second-stage forms of the duplex instrument used in Illinois. The item designations include letters E, M and D to identify the easy, intermediate and difficult test booklets of the second stage forms. Items that are marked by two letters, for example E and M, are link items common to the corresponding test booklets. A three parameter logistic model was used. Items that fail to fit the model at the .05 level are marked by a single asterisk; those at the .01 level by a double asterick. Very few items in the entire set of 888 failed to fit the model.

I. Comprehensive Educational Assessment for the States: The Duplex Design

COMPREHENSIVE EDUCATIONAL ASSESSMENT FOR THE STATES: THE DUPLEX DESIGN[1]

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According to a 1985 survey, 47 of the 50 states mandate some form of statewide testing of student attainment (Winfield, 1986). These testing programs vary widely in design: some employ traditional every-pupil achievement testing, others are limited to minimum competency testing, still others make use of matrix sampled assessment at benchmark grade levels.

The most widespread program is minimum competency testing: 23 states have centrally directed programs, and another 16 allow local options of test content and administration; in 23 of these 39 states, satisfactory performance on the test is a requirement for high school graduation. Standards for passing are set variously by state legislatures, state boards of education, and local education authorities.

Many states have multiple programs, usually some combination of outcome assessment and individual achievement testing. States that have achievement measurement or minimum competency programs test every pupil at selected grade levels, but some of those using matrix sampled assessment test in a sample of schools. Others, such as California, use matrix sampling

[1]We are indebted to Linda Winfield, Leigh Burstein, David Wiley, Zalman Usiskin, Tej Pandey, Pat McCabe, Joan Baron and Mervin Brennan for valuable suggestions. Preparation of this paper was supported in part by the Center for Student Testing, Evaluation and Standards, School of Education, UCLA, and in part by a grant from the Spencer Foundation.

methods, but test in all schools.

California is a prime example of a multiple-program state: the California Assessment Program provides curriculum-oriented evaluations of school outcomes; local school systems are required to conduct their own minimum competency testing; and data from the National Assessment of Educational Progress (NAEP) are available in California for purposes of comparison with national results.

States that have no centrally directed program may nevertheless require the districts to conduct periodic achievement testing. In Iowa, all districts test annually and, in fact, all use the same test. Finally, end-of-high-school tests in specialized subject matter areas are administered to selected students in some states (New York State Regents Examination, California Golden State examination). Winfield (1986) and Burstein, et al. (1985) give detailed accounts of existing and projected state testing programs.

Considering that the information needed to assess educational productivity must be much the same in all states, the variety of these programs is at first glance surprising. Closer examination reveals, however, that they arise from different emphases on outcomes for which schools should be held responsible. Where the main concern is certification of essential skills and knowledge, minimum competency testing is emphasized. Where the focus is on student attainment at all levels, especially when student guidance is involved, a commercial achievement testing program is usually relied upon. Where progress toward detailed curricular objectives is monitored, a matrix-sampling assessment program is the only practical approach. To the extent that mandated testing is committed to these disparate goals, the multiplicity of the existing state programs, with limited comparability of the resulting data, would seem to be inevitable.

We will argue, however, that with a suitable measurement design, a single, comprehensive assessment program can serve all of these purposes. We base this conclusion on an analysis of the information needs of the main users of educational test results within the states. The design we propose meets their needs directly and efficiently. In particular, it provides measures of achievement suitable for certifying attainment, for counseling students and parents, and for monitoring the effectiveness of schools and school districts. At the same time, it offers the detail and precision necessary for the evaluation of instructional methods and materials, and for basic educational

research. Moreover, it performs these functions in a cost-effective manner. We also suggest how results from independent state assessments based on the duplex design can be referred to a common scale to allow comparisons among states.

1. Educational information users

Anyone concerned with the conduct of education is conscious of the need for regular appraisals of student progress. Without such information, there can be no objective basis for guiding the student, for planning instruction, for evaluating schools, school systems and programs, or for correcting deficiencies or rewarding progress. It is not as well understood, however, that different forms of information about educational outcomes are required in these different applications. The first step in formulating the design must be an analysis of the anticipated uses of the results. These uses depend, of course, upon the *users* of the information. We delineate seven categories of such users.

Teachers, school counselors, parents, and the student. Standardized individual achievement tests, independent of particular teachers or courses, are widely used as aids to informed and fair decisions on student advancement and placement. In this role, the tests must have three important characteristics: 1) they must cover content that is relevant to the course work for which the student is responsible; 2) they must be sufficiently reliable that scores on alternative forms of the same test will, with high probability, lead to the same recommendations on individual advancement or placement; 3) the results must be presented in a form readily understandable to the parties involved.

Typically, content coverage is assured by specification of domains defined by a taxonomy of subject-matter topics. Items then are written for each category of the domain specification. The validity of the item classification may be checked empirically by inspection of the item-by-test score correlations, or by factor analyzing intercorrelations among items in a given content area. For the most part, writing items is reasonably straightforward once the domain specification has been formulated.

To construct from such items a number of test forms that will produce consistent differential measurement of students is, however, a more difficult

task. The problem is that decisions about students are made at all levels of the score distribution: low ranking students may be kept back or sent to remedial programs; high ranking students may be put ahead of their grade or assigned to honors programs; students in the middle range may be assigned to tracked classrooms differentially. To be accurate over the entire range, an achievement test must have a sufficient number of items to measure accurately at difficulty levels throughout the expected score distribution. To span this wide a range, an individual achievement test must be rather long.

As a result the testing time available usually restricts the number of proficiencies that can be tested to a relatively small number. A test that reliably estimates achievement in six areas, for example, may require three to four hours to administer. A major problem in comprehensive assessment is how to reduce the time required for dependable measurement of individual student achievement. Fortunately, new methods of adaptive testing, described below, make such savings possible.

In communicating achievement test results to teachers, parents, and students, we depend upon the normative nature of guidance-oriented use of test information. Teachers rarely make decisions about the student on an absolute basis; they can single out for special treatment only those students who deviate from the local standard. Because only rank-order information is required for such decisions, any form of reporting that indicates the student's standing in a reference group is suitable. In other words, "norm referenced" reporting is quite adequate for guidance purposes.

Designers of curricula and planners of instruction. In designing curricula or developing instructional methods and materials for the classroom, it is not the individual student that is to be evaluated, but the overall performance of students taught under different conditions. Although the classroom teacher has an interest in the outcome of such evaluations, it is primarily the school department head and principal, the professional curriculum specialist, and the textbook and workbook writer who will make direct use of these results. These workers need much more detail about student attainment than is available in traditional achievement testing. The problem is that measures of broad content areas produced by achievement tests tend to be insensitive to differential curricular effects. Although it has not been emphasized in the evaluation literature, this fact has been amply demonstrated in empirical

studies of alternative curricula. Walker & Schaffarzick (1974), in a lengthy review of research on science and mathematics curricula from 1956 to 1972, found that any given curriculum tends to be superior to others only in respect to material that is distinctive to it. Where the content and presentation are common among curricula, all perform equally well; thus, the differential outcomes are seen in contrasting score profiles, not in overall performance. A corollary of this finding is that the tests employed in such comparisons must be sufficiently detailed to measure separate outcomes for distinctive parts of the curricula. An instrument used to evaluate "new" math and traditional math, for example, would have to produce reliable scores for both of these types of content.

By the same token, instructional planners need to examine student performance in the units of content that can be manipulated in instruction. To write lesson plans for mathematics, for example, the instructors need to know the specific units–computation, number systems, problem-solving, applications, etc., that need attention. These units are almost always tested formatively, but time restrictions necessarily prevent their separate evaluation during summative testing of individual achievement.

The experience of the California Assessment Program suggests that, to be useful, an evaluation instrument must distinguish perhaps 20 to 40 curricular objectives at a given grade level. Although it is not possible to test this many topics with individual achievement tests, individual measurement is not necessary in program evaluation: only the average performance of classrooms or other experimental units need be measured for this purpose. If the number of students in the programs is sufficiently large, good precision in estimating program effects can be obtained without the use of long tests. The generalizability of the group mean scores is the important consideration, not the reliability of scores for individual students.

It has been known for some time that to obtain adequate generalizability in estimating program effects, evaluation should not be based on the traditional achievement test, but on an instrument in which each student responds to only a few items sampled from each of numerous content elements, while different students respond to different samples of items. This approach assures good generalizability of the group mean for each element with minimal demands on testing time. It is the basis for the multiple matrix-sampling designs used in the National Assessment of Educational Progress and in

numerous state testing programs. In these designs, the test instrument is constructed in many forms, 15 to 30, or sometimes more, with a small number of items assigned randomly to each form from the pool representing each curricular objective or element. Lord (1980) has shown that the most efficient matrix sample is one in which each student in the group is assigned one distinct item from each element. In that case, the number of curricular objectives that can be assessed in one form is then equal to the number of items that the student can respond to during the testing period, usually 30 to 40. This number is quite adequate for a highly detailed curricular evaluation.

The scoring of matrix sampled instruments is also different from that of achievement tests. In the original formulation of matrix sampling (see Lord, 1962), the scores are not presented in any normative form, but simply as average percent correct for each content element. Classrooms, groupings of students, instructional programs, schools, and other aggregations are then compared with respect to the strengths and weaknesses revealed in the profile of average percent correct scores over detailed curricular elements. Since these elements usually correspond to units or topics of instruction, definite recommendations about teaching practices or emphasis can be made from such results.

More recently, Bock, Mislevy and Woodson (1981) have shown how matrix-sample data can also be analyzed and scored by use of scaling techniques based on item response theory (IRT). According to this theory, the probability that a student will respond correctly to a given test item is a function of the student's location on the proficiency dimension and of properties of the item, such as its difficulty and validity. The properties of each of the items in a test can be estimated from large samples of responses and used to estimate a "scale score" for the student indicating his or her proficiency level.

Average percent correct scoring and IRT scale scoring both retain the detail necessary for curricular evaluation and instructional planning, but scale scores have the advantage of remaining comparable as items are added to or retired from the instrument from time to time. This consistency of interpretation as the item content is updated is essential if educational progress is to be followed over long periods of time. Recently developed IRT test maintenance systems provide for the detection and correction of drift in the relative difficulties of items that may occur over time.

Local school system managers, officers, and boards. In making decisions on personnel, resource allocation, and policy, school officials must be able to support their actions with data on educational outcomes in the schools for which they are responsible In addition to such operational statistics as number of students in school, number of hours of schooling, teacher/student ratio, etc., they need measures of outcomes in the relevant subject matter areas at a number of grade levels. The detail required depends somewhat on the style of administration or oversight of the persons involved. Superintendents and boards that have considerable experience with education and instruction probably will be interested in more detail than is available from achievement testing, although perhaps not to the same extent as the curriculum specialist. They will not, however, be interested in a level of score reporting below that of the classroom or school. Because their concern is with group-level rather than individual outcomes, they can make profitable use of the matrix sampling methods of program evaluation. The only difference is that classrooms or schools rather than programs are being evaluated, a distinction that is conveyed by describing the activity as "assessment" rather than "evaluation".

Assessment procedures based on matrix sampling designs have the advantage of providing a detailed profile of aggregate outcomes without intruding excessively on classroom time. Equally advantageous, however, is their resistance to effects of "teaching to the test". Because there are so many items in the forms that make up assessment instruments, it is difficult for a teacher to discuss enough of the items to have any great effect on the school outcome. Indeed, if the assessment represents the full range of curricular objectives, an attempt to teach a majority of the items would be virtually equivalent to teaching the subject matter of the course. In addition, if scale scoring is used, a proportion of items can be replaced periodically to protect further the integrity of the test.

Achievement tests, in contrast, typically exist in only a few forms and are not always updated regularly. If school districts use the same achievement tests from year to year, the items tend to become known to the teachers, who may then consciously or unconsciously teach the specific information required to answer particular items. If so, the tests will tend to show year-to-year average gains that do not reflect increased general knowledge of the subject matter on the part of the student. The more pressure the teachers are

under to improve student outcomes, the greater the probability that these teaching-to-the-test effects will appear.

Whether the information on student progress comes from achievement tests or assessment, it is important to school officials that the scores be reported on a scale with fixed origin and unit so that gains or losses in each subject matter area can be compared over a period of years. The sort of rank order information that is acceptable for comparing individual students is not suitable for monitoring the progress of schools and school systems. Average number correct scores in assessment results have this property, but they have the disadvantage of losing their comparability if some items are retired from or added to the content areas assessed. As Lord (1980) has discussed, IRT scoring of tests facilitates both the equating of test forms and the updating of item content within forms. This theory also allows accurate calculation of measurement error variances at all points on the scale. These error-variance estimates can in turn be used in obtaining efficient, weighted estimates when aggregating data to the school or district level, and in expressing results in the form of confidence intervals that convey uncertainty due to the sampling of both students and items. We discuss below these and other contributions of item response theory to educational assessment.

State departments of education. The activities of most state departments of education are sufficiently varied to benefit from all of the outcome measures described above. Departments that formulate curricula or set objectives need feedback from the assessment of detailed curricular objectives. Most states employ for these activities professional specialists whose work depends critically on this type of information. At the same time, most departments of education are also concerned with the performance of schools as measured by numbers of students reaching or exceeding defined levels of achievement, whether minimal, ordinary, advanced, or outstanding. For these purposes, individual achievement measures in broad subject matter areas are required. For just this reason many states operate assessment programs simultaneously with conventional, in many cases commercial, achievement testing.

Some states have limited assessment programs based on sampling of schools and students within schools. If the state also has a policy of accountability of school districts for levels of student attainment, however, this type of sampling is not sufficient, and a complete census based on every-pupil

testing is preferable. The effort can be well repayed: because the census provides accurate information at the level of the individual schools, results can be reported in a form that is interesting and informative locally, and schools with exceptional outcome patterns can be identified throughout the state. If the state makes special grants to improve average student performance, or rewards such performance financially, then a complete census is, of course, essential.

An additional problem with a sampling assessment is that the schools have no immediate payoff. Motivation for cooperation on the part of both staff and students is minimal, and levels of performance may suffer as a result. Apart from the lower cost of sampling assessment, there is little to recommend it over an every-pupil program.

The quality of information that state departments of education have at their disposal is also generally better when the test data take the form of original response records of the individual students. Although districts may have the capability of scoring tests and reporting summary statistics, the information can be analyzed more consistently and in more detail if primary rather than secondary data are available to the department.

State legislators and officials. At the state level, representatives not exclusively involved in education can attend only to rather general indices of educational outcomes. They cannot go into the detail that would interest the curriculum specialist, or even the more limited achievement profiles required for student counseling. Their concern is primarily with the main subject matter areas measured at a few benchmark grade levels, e.g., 4, 8, and 12. Often, year-to-year gains and losses are of more interest than absolute levels of attainment. The statistics necessary for these general summaries of educational progress can readily be obtained by aggregating the more detailed assessment figures at the school or district level. The precision and generalizability of these statistics will be so high that the confidence intervals required at lower levels of aggregation will seldom be necessary, although they can be calculated if required. If reported in the form of scale scores, the results will remain comparable over relatively long periods of time, and long-run changes in the average performance of students in the state can be traced.

By examining such data, state officials may be able to infer the impact

of current social trends on student performance (e.g., television viewing or microcomputer use). They may then be able to anticipate educational problems that will eventually influence public policy or legislation. Long-term stability and consistency of a state's assessment program and procedures are essential to such inferences.

The media and the public. Communicating school performance data to the general public is a challenging task for the educational evaluator. The key to success is making the findings understandable to the journalists who must report such information in the newspapers and on radio and television. Reporting of average percent correct for a content area, which provides only relative information and varies in level from one content area to another, is especially troublesome because the audience has to keep in mind that the scales are not comparable. A much better practice is to employ scale scoring, defining a scale with a common origin and unit for all subject matter areas and employing it uniformly until its characteristics become well-known. Comparisons between schools or groups of students can then be expressed in familiar numbers, and year-to-year gains or declines in student performance can be followed in units that have a widely understood meaning. Certain achievement scales, such as that used to report Scholastic Aptitude Test (SAT) scores, have achieved this status.

An even more comprehensible form of reporting, however, is to state the percent of students who fall above or below certain thresholds on the attainment scale. If these points correspond to administrative cutting points (e.g., for graduation, special honors, admission to college, etc.) their practical implication is entirely clear. If these objective criteria do not exist, the item content typical of selected score levels can be exhibited to convey the nature of the tasks that students at these levels can typically perform. The NAEP reading scale, for example, is characterized for reporting purposes by displays of items that students at the 150, 200, 250, 300 and 350 points on the scale have an 80 percent chance of answering correctly.

Another possibility is to take a normative approach and to designate certain arbitrary percentile points in the population of students. The 25, 50 and 75 percent points, for example, might be referred to as the "basic," "intermediate," and "advanced" mastery levels. In this connection, however, it must be mentioned that achievement testing and assessment are quite dif-

ferent when it comes to estimating the percent of students above a specified performance threshold. In achievement data, it is a simple matter to obtain these percentages by enumerating students whose individual scores fall in the defined intervals. But from matrix sampled assessment data, individual scores are not available, and the percent of students above some point on the scale of the group means can be estimated only if the distribution of proficiencies within the group can be described. Up to now, the information necessary to estimate these within-group distributions has not been part of assessment results; it has had to come separately from conventional achievement tests rather than matrix sampled assessment designs. One of the main strengths of the duplex design is that the proportions of students exceeding specified mastery levels can be estimated in the same manner as in achievement testing. This enables percents of students at specified levels to be estimated directly.

Educational research specialists. A constituency independent of school systems, yet having an interest in the information generated by state testing programs, consists of academic and professional research workers engaged in study of education and the schools. In principle, they can use information from either achievement testing or assessment. But like the curriculum specialists, they are also often interested in detailed areas of attainment, not just the broad skill areas measured by individual achievement tests. The data from assessment programs may be more relevant to them than traditional test scores. Assessment data will also typically have higher generalizability indices, and thus clearer relationships with other variables.

The effect of matrix sampling on generalizability is demonstrated by the estimated correlation coefficients shown in Table 1. The data are reading score means in California schools measured in two successive years. Notice that the sizes of the correlations increase (the school means become more accurate) as the sizes of the samples of students increase from row 1 to row 3. Similarly, the correlations increase when student sample size remains fixed, but the numbers of items sampled increase from 85 in a single test form, to 128 in 16 forms, to 400 in 40 forms. This latter effect arises from the increased generalizability due to item sampling. It would be even more pronounced if different items were sampled each year. It would then maximally suppress the effects of item heterogeneity that attenuate relationships between student

TABLE 1

Effect of sampling of students and sampling of items on the year-to-year correlations of sixth grade mean reading attainment scores of California schools

		Number of items in matrix sample		
		85	128	400
Number of students	50	.59	.73	.79
sampled	100	.67	.78	.88
per grade	200	.76	.81	.93

attainment and the background variables.

Because most standard computer packages require scores for individual respondents, matrix sampled assessment data can present something of a dilemma to research workers. Only more advanced investigators currently know how to use matrix sampled data directly by hierarchical methods; (see Mislevy, 1985). Until computer packages become available for these methods of analyzing scores that exist only at the group level, the data obtained from matrix sampling designs will not be convenient for secondary analysis. In this respect, the duplex design proposed in this paper has a marked advantage: it supports scoring of the item response data at both the individual and the group level. Research workers can thus make use of either of these types of data depending on their statistical expertise.

2. Uses of attainment information

The uses of information on student attainment identified above can be classified in terms of the decision-making activities supported.

Guidance: counseling, placement, promotion, and certification of individual students. Each of these uses accurate test scores in at least the main areas of proficiency and subject matter in the curriculum. Standardized achievement testing is a main source of this information.

Evaluation: choosing among competing curricula, instructional programs, or educational materials. These choices require information on the perfor-

mance levels of groups of students pursuing alternative programs or using different materials. Matrix-sampling assessment, making minimal demands on student testing time, provides this type of information at the group level, but scores for individual students are not available by this method.

Management: monitoring student attainment in programs, schools, and school systems. Managerial decisions can utilize measures of attainment at the classroom or school level. They need much the same level of detail as evaluation studies. Resistance to teaching-to-the test is vital in this use. This information need is better served by assessment methods than by individual student achievement testing.

Policy: judging the overall progress of an educational system, or its main components, for purposes of formulating legislation and allocating resources. Policy decisions can utilize statistics of attainment aggregated to the district or state level. They do not require the level of detail needed in program evaluation or school management. The required information can be obtained equally well by achievement testing or by assessment results summarized in broad areas of proficiencies or subject matter.

Research: secondary studies of the conditions and background variables that influence student attainment. Statistical methods in educational research typically depend upon accurate scores for individual students. The existence of widely used, well-defined scales for reporting results greatly facilitates such studies. Student achievement testing based on standardized measures has traditionally served this purpose.

3. Combining student achievement testing and assessment of curricular objectives

It should be clear from the preceding discussion that traditional individual achievement testing differs in important ways from assessment of the success of schools or programs in attaining specific curricular objectives. Up to now, these two types of educational measurement have been conducted in separate testing programs using different instruments. Because the item content of these instruments is much the same, however, substantial duplication of cost, effort, and demand on classroom time is incurred to obtain the same information in different forms.

We suggest that with a suitably designed assessment instrument, both of

these forms of information can be obtained in a single test administration requiring no more classroom time than conventional achievement testing. The instrument we propose for this purpose, which we call a "duplex design", has multiple stratified random test forms like those used in assessment. The items are assigned to forms in such a way that a student's response to a particular form can be scored in broad skill and content areas, while responses over forms can be aggregated to provide scores for detailed curricular objectives at the school or other group level. An example of the layout of an instrument of this type in eighth grade mathematics is shown in Table 2.

The design in Table 2 is based on the assumption that mathematics attainment is expressed in three broad categories of behavior, called "proficiencies". These proficiencies are derived from cognitive distinctions between procedural knowledge, semantic knowledge, and problem solving. The mathematical substance of the proficiencies is classified in the content categories of the discipline as reflected in current curricula and textbooks at this grade level. Scores for individual students can be calculated within forms in three ways. First, scores for each of the three proficiencies are obtained by aggregating over content. Second, diagnostic scores in the main content categories (Numbers, Algebra, Geometry, Measurement, and Probability & Statistics) are obtained by aggregating over the proficiencies and over the subtopics within the main content categories. Third, an overall score for mathematics is computed by aggregating over all items.

At the same time, scores for schools or other groups of students can be calculated for each of the 57 elements in the table by aggregating over test forms. When the scoring methods described in Mislevy & Bock (1987) are used for this purpose, the mean of the proficiency or of the content area scores of students in a given school will equal the mean of the school-level content-element scores within that proficiency. Thus, the several types of information extracted from the duplex design are expressed on the same scale of measurement.

Depending on the item pool, not all of the curricular elements may be included when the design is implemented. In a prototype of the grade 8 mathematics design based on items from the California and Illinois Assessments, content categories 15 (irrationals), 23 (inequalities), and 44 (other systems of measurement), 52 (experiments and surveys) were not represented. In the

TABLE 2

A GRADE 8 MATHEMATICS DUPLEX DESIGN

Content Categories		Proficiencies		
		a. Procedural Skills[a]	b. Knowledge of Facts & Concepts[b]	c. Higher Level Thinking[c]
10.	*Numbers*			
	Integers	11a	11b	11c
	Fractions	12a	12b	12c
	Percent	13a	13b	13c
	Decimals	14a	14b	14c
	Irrationals	15a	15b	15c
20.	*Algebra*			
	Expressions	21a	21b	21c
	Equations	22a	22b	22c
	Inequalities	23a	23b	23c
	Functions	24a	24b	24c
30.	*Geometry*			
	Figures	31a	31b	31c
	Relations & Transformations	32a	32b	32c
	Coordinates	33a	33b	33c
40.	*Measurement*			
	English & metric units	41a	41b	41c
	Length, area & volume	42a	42b	42c
	Angular measure	43a	43b	43c
	Other systems (time, etc.)	44a	44b	44c
50.	*Probability & Statistics*			
	Probability	51a	51b	51c
	Experiments & surveys	52a	52b	52c
	Descriptive Statistics	53a	53b	53c

[a] Calculating, rewriting, constructing, estimating, executing algorithms.
[b] Terms, definitions, concepts, principles.
[c] Proof, reasoning, problem solving, real-world applications.

prototype instrument, these elements were replicated in 24 booklets containing a total of 1080 items. The items in any given form were chosen randomly from the pools representing each of the curricular elements.

In the administration of this type of instrument, the booklets are distributed in rotation within classrooms. The fact that different students may be responding to different forms and items does not typically present any difficulty. This method of test administration has been used widely in assessment programs with good success. In particular, the experience of the California Assessment shows that, when expendable test forms are used, group testing with this type of instrument can be carried out as early as the third grade.

4. The contribution of modern item response theory (IRT)

Efficient estimation of comparable scores for all students, regardless of which test form they are assigned, requires the use of modern IRT methods of item scaling. Because the item content of each of the scales is perfectly balanced in the duplex design, the scoring is robust in the presence of minor departures from the conditional independence assumed in conventional IRT methods. In the implementation of these methods, the instrument is administered initially to a probability sample of students at the selected grade level. The test items are then calibrated, preferably by the marginal maximum likelihood method (Bock and Aitkin, 1981), with the unit and origin of measurement chosen so that the mean and standard deviation in the population of students is the same for all scales in the base year. The resulting item parameters are then used to compute students' scores by maximum likelihood or Bayes methods, and each score is accompanied by a standard error or posterior standard deviation. Scores computed in succeeding years with these item parameters have constant origin and unit and are suitable for measuring growth and change in the population from the base year onward. Because IRT methods are used, it is possible to add and retire items from the test without altering the initial definition of the scale. This updating can be done as part of the operational administration of the test without additional field trials. New developments in item response theory also account for effects of so called "item-parameter drift" while retaining the original scale definition

(Bock and Muraki, 1986). This armamentarium of IRT techniques, along with provisions for writing and critiquing new items, constitutes the item maintenance system that supports the comprehensive assessment program.

Scores for schools or other groups of students can be estimated by IRT methods using the models for group data described by Mislevy (1984). These methods provide scores for the curricular elements on the assumption that each pupil responds to one item from each element. The duplex design satisfies this condition. This type of scoring is especially easy to carry out because it uses, as statistics, the number of students who attempt each item within the classroom or school and, among those, the number who respond correctly. Thus, the calculations require only a classroom or school summary file rather than the much larger file of individual item responses required for the scoring of students in the skill areas.

5. Adaptive testing

With the aid of IRT scoring methods, it is possible to minimize testing time by using some form of adaptive test administration. Ideally, one would prefer individual, fully adaptive, computerized test administration in which each item presented to the examinee is most informative, given the provisional estimate of the examinee's proficiency. But almost equal gains in efficiency can be obtained by group-administered, two-stage testing (Lord, 1980). In this form of testing, each student takes a short pre-test of general knowledge in the subject matter area. This pre-test is then scored by the teacher prior to the main test, and the student is assigned the appropriate second-stage form according to the result. A feasibility trial of a two-stage form of the duplex design for eighth-grade mathematics described above is presently being conducted in Illinois and California as a project of the OERI Center for Student Testing, Evaluation and Standards. The assessment instrument for this study consists of a 12-item pretest and 8 second-stage forms at each of three levels of difficulty—easy, intermediate and hard. At the student level, the instrument tests three mathematics proficiencies and five main content areas, and at the classroom and school level, 45 distinct curricular elements. A report of this study is in preparation (Bock, et al., 1987).

6. Reporting

To be most broadly useful, a comprehensive assessment should produce reports for a variety of audiences. Computer generated reports, with explanatory comments, should be supplied to students, classroom teachers, school department heads and principals, district supervisors, the state department of education, and the media. Possible content and reporting forms for this purpose are suggested in this section and illustrated for the duplex design in Table 2. The results shown are taken from the Illinois field trial of the duplex design in eighth grade mathematics. The names of the student, teacher, and school have been changed.

Students. A report to individual students, to be shared with their parents, and a similar copy supplied to the student's classroom teacher, might take the form shown in Figure 1. The student's profile of scale-scores in the main skill and content areas is presented both graphically and numerically. In the graph, the score value is represented by a small diamond bracketed by a 66% confidence interval on the true score. The numerical value of the score is also shown at the right. The heavy vertical line represents the student's overall mathematics score.

The origin and unit of the scale scores are assigned in the first year of the assessment and remain fixed thereafter. In Figure 1, a scale similar to that used by the California Assessment Program and by NAEP is shown: the mean for the state is set at 250 and the standard deviation at 50. The range of the scale is 0 to 500.

To aid in the normative interpretation of the scale, percentile points of various score distributions are shown for selected points on the scale. The student reports include percentiles for the classroom to which the student is assigned, for the school, and for the state or higher level population. Percentiles for the state are the same on all forms and can be printed beforehand; those for the school and classroom are overprinted by computer along with the information pertaining to the particular student.

In addition, the scale is criterion-referenced to certain mastery levels defined by test items having thresholds near these points. In the displays shown here, three mastery levels are distinguished: *basic*, *intermediate* and *advanced.* The implication is that students who fall in the basic range are candidates for some form of additional instruction or remediation, those in

the intermediate range are progressing at the normal pace, and those in the advanced range should be given opportunities for special instruction or activities in the relevant subject matter.

The deviation of the students confidence intervals about the heavy vertical line to the right indicates areas of relative strength, and to the left, areas of relative weakness. In the display of a student showing uniform progress, (not requiring additional work in any skill or topic), all confidence intervals would overlap the vertical line.

Schools. The reports intended for the district superintendents and school principals take the two forms shown in Figure 2. The first form, shown in Figure 2A, summarizes the proficiency and content scores of all students at the grade level. The distributions of student scores are depicted as histograms, and the percent of students at each mastery level is shown. The school mean for each skill and topic is shown at the right along with the corresponding state percentile. The percentile refers here to the state-wide distribution of school means and not to the distribution of individual student scores. Each percentile shows the ranking of the mean of this particular school among the means of all schools in the state. The heavy vertical line represents the overall mathematics mean score for the school; it is also expressed as a percentile of the state-wide distribution of school means.

The second form of the school report, shown as Figures 2B and 2C, summarizes the school scores for each of the 45 cuirricular elements covered in the duplex design. The school level score for each element is marked by a diamond, and the corresponding horizontal bar is the plus-or-minus one standard error confidence interval on the school true score. Notice that the confidence intervals are shorter than those for individual students because of the greater stability of school level scores. The range of the scale can also be shorter because the variation between schools is less than that between students.

Emulating the reports of the California Assessment Program, the school report also includes a rectangular box or "comparison band" for each curricular element. The band represents the range of scale scores for the element that would be expected on the basis of the resources and community background of the school. The length of the confidence band allows for both the prediction error and the measurement error of the respective element scores. From data for the state as a whole, relationships are empirically determined

to best predict the performance of the school from measures of economic and social characteristics of the school district. These relationships give a range of scores that would reasonably be expected from knowledge of the characteristics alone. They permit the performance of the reported school to be compared with that of other schools with similar characteristics. If the scale score of the school lies to the right of this band, then the effectiveness of its instruction for the curricular element is better than might have been expected. If the scale score falls to the left of the comparison band, the effectiveness of the school's instruction in the curricular element is poorer than might have been expected. These comparisons reveal relative strengths and weaknesses in the school's instructional program.

State. For state-level summaries of student and school performance, the displays in Figures 3A and 3B are informative and easily understood by the general public. The state-level information is summarized in terms of overall mathematics achievement rather than scores for proficiencies, content, or curricular elements. Figure 3A shows the estimated distribution of overall mathematics scores for all students in the state. Data for the current year and the previous year are presented in order to show the direction of change. Both the state's scale score and the corresponding national percentile are presented. The 1985 data and the national percentile in Figure 3A are hypothetical; the 1986 data are based on the Illinois field trial. The median score of students in the state is shown as a heavy line, and the percent of students in each of the mastery levels is also given. The graphs convey both the numbers and the percent of students who are achieving in eighth grade mathematics at recognized levels of mastery. This is the form of data that is of most interest to state officials, legislators, and public.

Graphical presentations similar to Figure 3B, which shows here the absolute and relative overall mathematics performance of the 32 schools in the Illinois field trial, would be of special interest to state departments of education and the media. By the use of code numbers, the display shows the mathematics achievement scale score for each school relative to the score that would be predicted on the basis of the school's characteristics and resources. It is apparent from Figure 3B that these predictions are relatively accurate in the Illinois data. The middle diagonal black line on the graph shows the expected score, and the vertical distance of a school's location from that

line indicate 'ative performance. If this distance is greater than the 97.5 percent bound indicated by the upper diagonal line, the school is performing better than expected from community characteristics, if it is below the 2.5 percent bound indicated by the lower diagonal line, the school is performing more poorly than would be expected on these grounds. On this graph, anyone privileged to view the key to the school codes could see immediately those schools that are relatively more effective in teaching eighth-grade mathematics, and those that are relatively less effective. The chart is a basis for addressing the accountability of schools for the attainment of their students in this subject matter.

Media. Any of the foregoing reports from the school level upward could be released to the media. A considerable amount of descriptive material and comment may have to accompany the quantitative reports in order to make them understandable to reporters and the public. As an aid to interpretation of the results, a good practice is to display actual items from the test. The pre-test items of the two-stage testing serve this purpose admirably. Because of the high level of exposure of these items, they would be replaced annually and thus will be available for release to the public immediately following the testing. Having been chosen from among items of high discriminating power and covering a wide range of general mathematics proficiency, they are among the most powerful indicators of overall attainment in the subject matter. The locations of their thresholds on the scale score continuum can be presented graphically as a means of content-referencing the scale.

7. Between-state comparisons

The utility of state assessments can be further enhanced by expressing the results in terms of a common scale, preferably one for which national norms exist. State can then be compared with state, and state with nation, for purposes of evaluating educational programs and promoting economic development. National norms could, of course, be obtained by administering the state test in a nation-wide sample of schools, but the prospect of all, or most, of the fifty states undertaking such surveys is not pleasant to contemplate. By use of equating methods, a much more efficient and less intrusive approach is possible. All that is needed is to administer, to a sample of

students who have taken the state test, a nationally normed test covering approximately the same content as part or all of the assessment instrument. Statistical methods could then be used to obtain the best unbiased prediction of the national test scores from the scores on the state test. The predicted national test scores could then be aggregated to the school district or state level for purposes of comparing educational performance in one state with the national norm or with any other state using a similar procedure to express its assessment results.

From the normative score distribution of the national test, the predicted scores could be interpreted in terms of percentiles of the national population in the same way that the student scores are interpreted in local and state percentiles. This method has already been used to express the reading comprehension scale of the California Assessment Program in the units of the Degrees of Reading Power test at the eighth grade level (Bock, Sykes, and Schilling, 1987). As a source of national test scales in terms of which state assessment results could be expressed, the National Assessment of Educational Progress is an obvious candidate, provided it could produce scores at the pupil level suitable for this purpose.

8. Conclusions

Our analysis of the potential users of data on educational outcomes—students, parents, teachers, school counselors, school administrators, boards and officials, curriculum experts, textbook writers, state legislators and departments of education, and educational research specialists—leads us to conclude that currently existing programs for evaluating educational productivity should, and can, be redesigned to serve the needs of this varied community. We propose for this purpose the "duplex design", which supplies achievement scores for individual students in the main areas of proficiency and content while at the same time evaluating the progress of schools in attaining the detailed objectives of the instructional program and curriculum. Based on new developments in educational statistics and measurement, including item-response theory, matrix sampling, and two-stage testing, the duplex design is capable of delivering this range of information with no greater demand on testing resources and classroom time than is now required in conventional every-pupil achievement testing.

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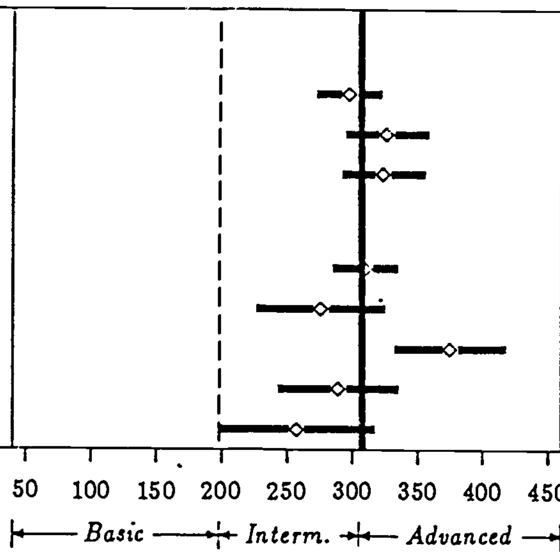
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: David Taylor
Teacher: Mary Jones
Class: Math8G
School: Sanderson
Date of Testing: December 12, 1986

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	School	State
SKILLS				
Procedures	299	78	70	84
Knowledge	328	93	90	94
Problem Solving	325	96	89	93
TOPICS				
Numbers	311	89	76	89
Algebra	277	80	70	71
Geometry	376	98	99	99
Measurement	290	81	65	79
Statistics	258	53	44	57

Overall math score	308 ± 19
Class Percentile	93
School Percentile	87
State Percentile	93

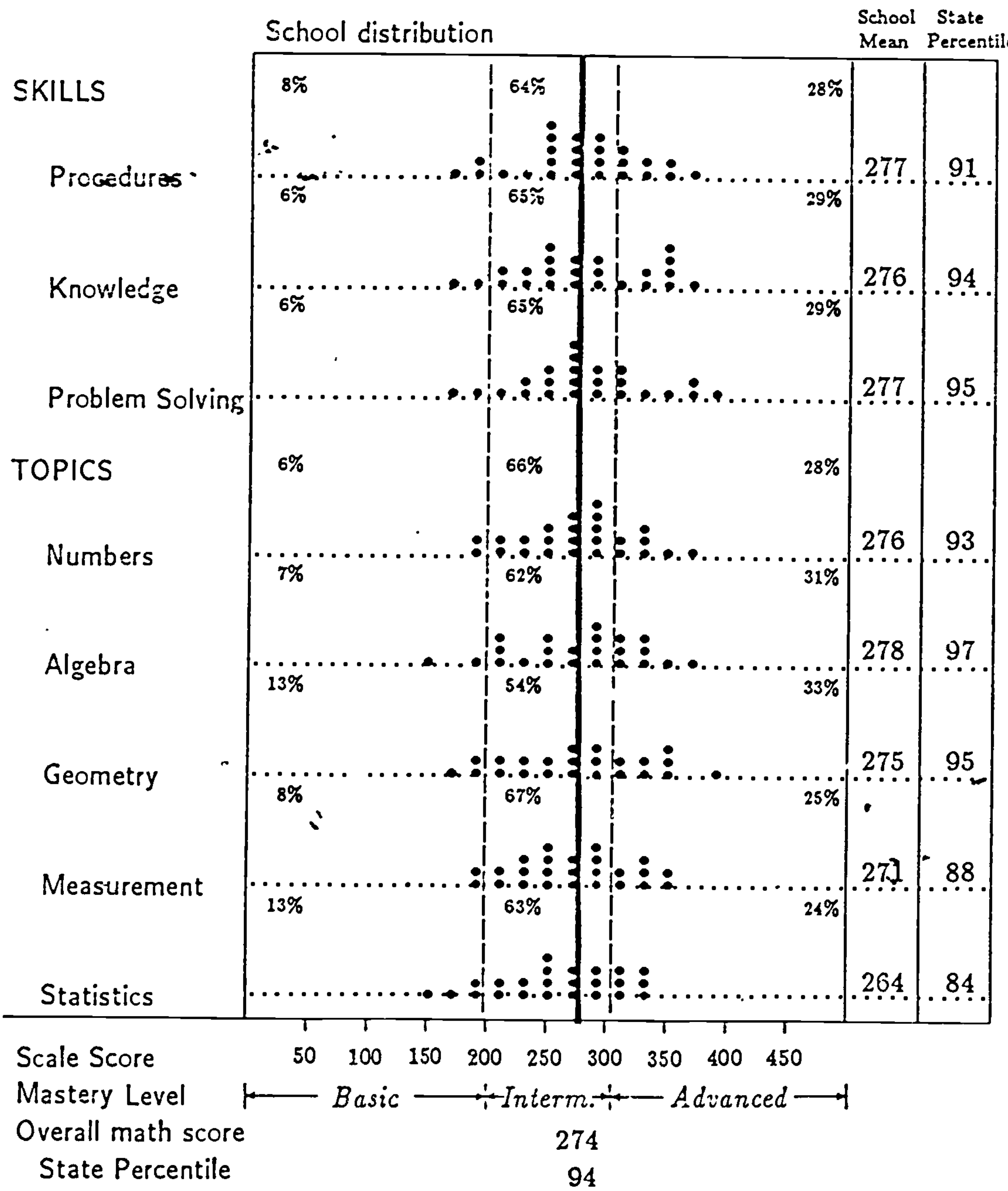
EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

Survey Test of Grade 8 Mathematics

SCHOOL REPORT

School: Sanderson
Date of Testing: December 12, 1986
Number of Students Tested: 72



EXPLANATION: Each • represents about three students. The heavy black vertical line marks the overall average score of the school in mathematics.

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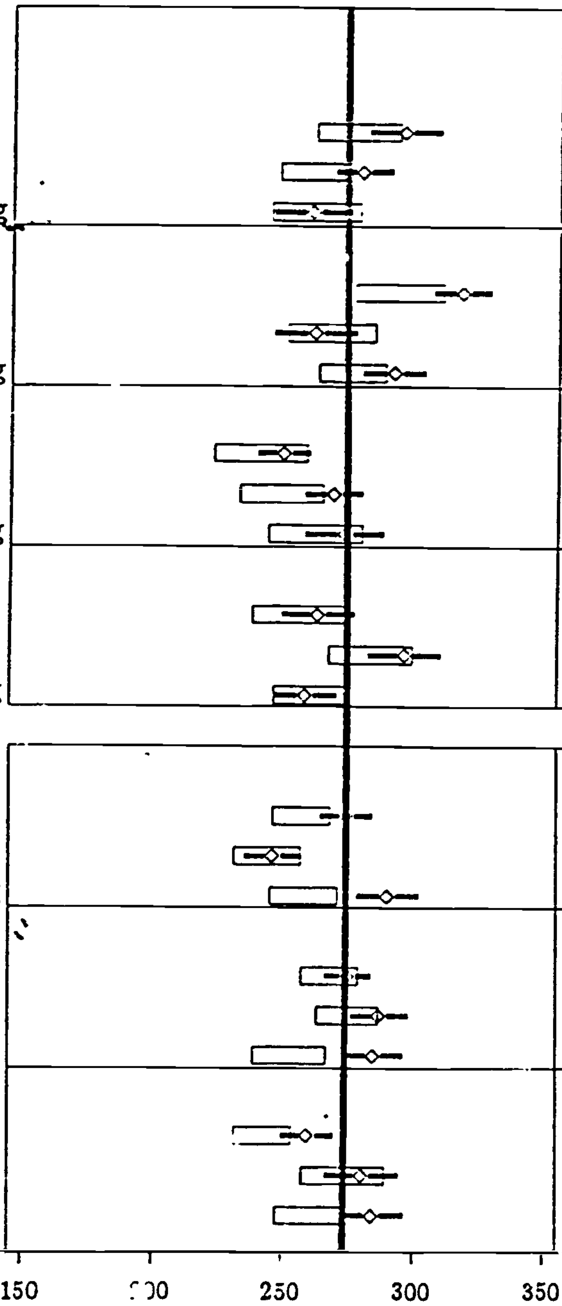
Figure 2A

SCHOOL REPORT (page 2)

School performance on curricular objectives

Objective profile (◇), confidence intervals (—◇—) and comparison bands (▭)



Objective	Scale Score	State %tile	Percent Correct
1. NUMBERS			
Integers			
Procedures	296	97	64
Knowledge	280	98	72
Problem Solving	261	78	60
Fractions			
Procedures	318	97	81
Knowledge	262	82	58
Problem Solving	292	95	63
Percent			
Procedures	250	71	53
Knowledge	269	80	61
Problem Solving	273	79	46
Decimals			
Procedures	263	64	56
Knowledge	296	98	79
Problem Solving	258	73	67
2. ALGEBRA			
Expressions			
Procedures	274	91	69
Knowledge	246	48	42
Problem Solving	290	100	58
Equations			
Procedures	275	80	49
Knowledge	287	93	58
Problem Solving	285	99	58
Functions			
Procedures	260	99	53
Knowledge	281	93	38
Problem Solving	285	99	64

Scale Score

Overall math score 274

Procedures: Calculating, rewriting, constructing, estimating.
Knowledge: Terms, definitions, concepts, principles.
Problem Solving: Proof, reasoning, real-world applications.

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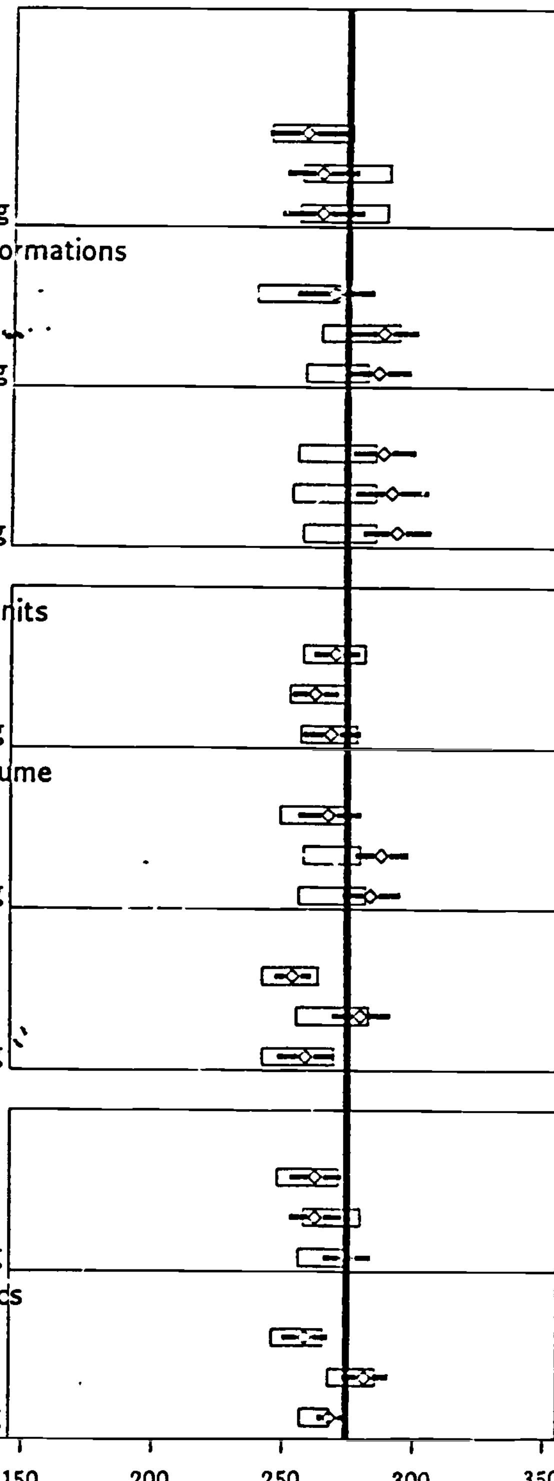
SCHOOL REPORT (page 3)

Objective profile (◇), confidence intervals (—◇—) and comparison bands (▭)



	Scale Score	State %tile	Percent Correct
3. GEOMETRY			
Figures			
Procedures	258	69	49
Knowledge	264	73	49
Problem Solving	264	80	49
Relations & transformations			
Procedures	269	95	54
Knowledge	288	84	57
Problem Solving	286	96	39
Coordinates			
Procedures	288	89	54
Knowledge	291	94	51
Problem Solving	293	98	57
4. MEASUREMENT			
English & metric units			
Procedures	270	91	54
Knowledge	262	78	49
Problem Solving	268	81	40
Length, area & volume			
Procedures	267	70	44
Knowledge	287	100	54
Problem Solving	283	95	57
Angular measure			
Procedures	253	74	43
Knowledge	279	89	50
Problem Solving	258	70	40
5. STATISTICS			
Probability			
Procedures	262	69	44
Knowledge	262	50	58
Problem Solving	274	95	51
Descriptive statistics			
Procedures	258	66	43
Knowledge	281	81	60
Problem Solving	268	84	63

Overall math score 274

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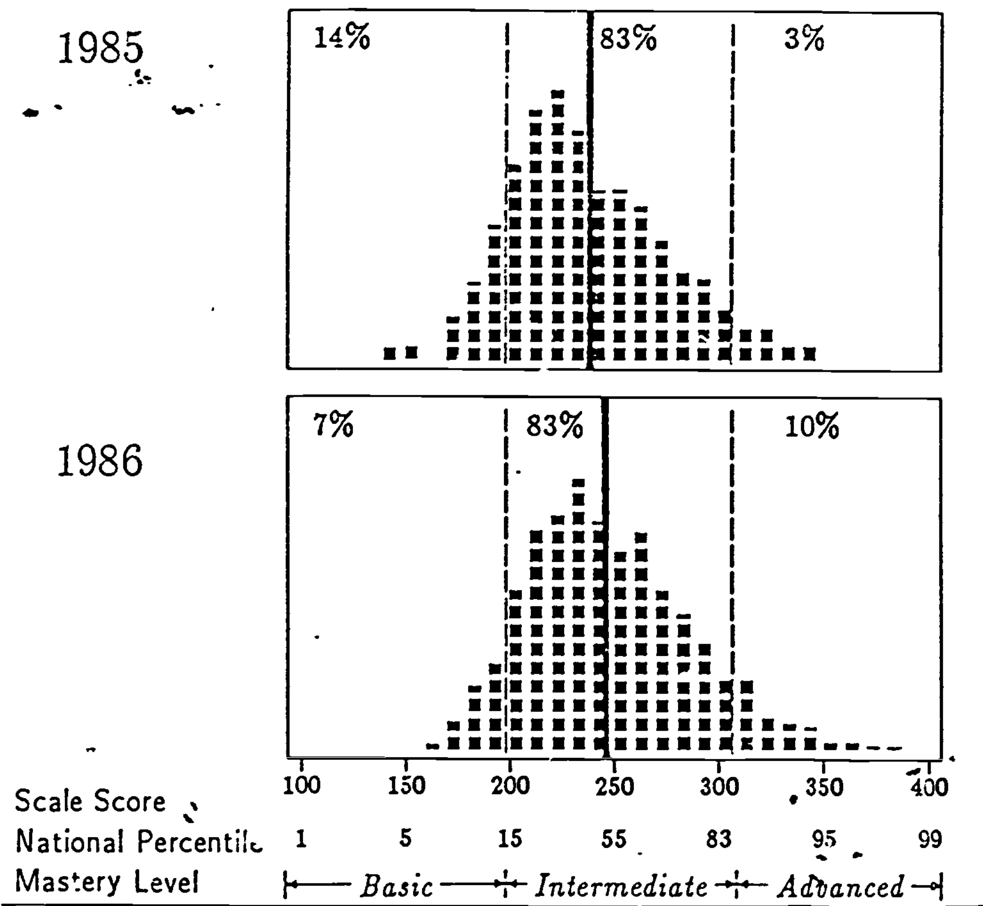
STATE SUMMARY

Mathematics scores of 8th Grade Students in 1985 and 1986



EXPLANATION:
Overall mathematics attainment of 8th grade students in December of 1985 and 1986. Each box (■) represents 1000 students. The heavy line (I) is the median score for each year.

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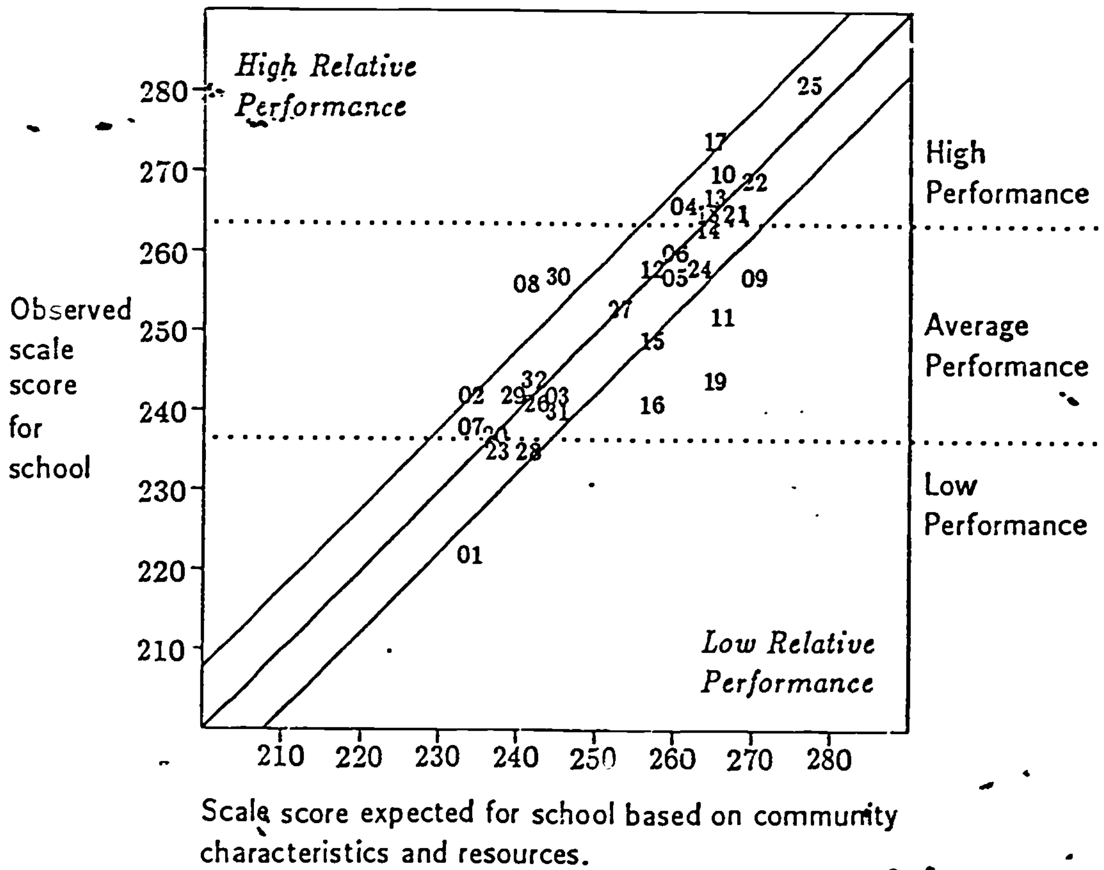
Figure 3A

STATE SUMMARY

School Performance Chart
8th Grade Mathematics



EXPLANATION:
The location of schools on the performance chart is indicated by their identification codes. *Absolute* performance levels are given by the positions of the schools on the scale on the left. Performance *relative* to other schools with the same community characteristics and resources is indicated by the vertical distance of the school code from the heavy diagonal line. Schools located above the upper light diagonal line are performing better than expected. Those below the lower light diagonal line are performing less well than expected.

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II. Sample Score Reports from the Illinois Tryout

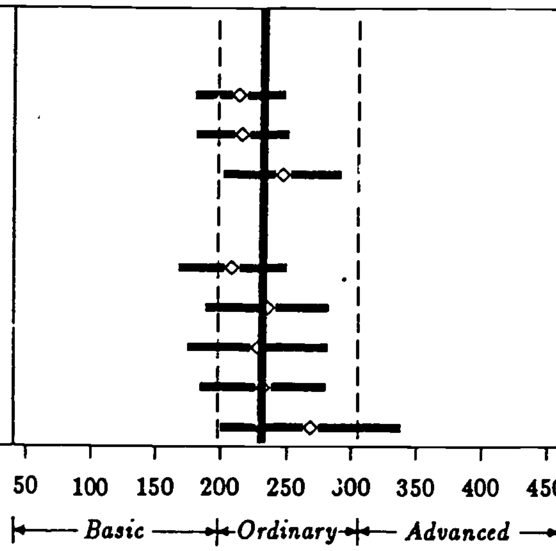
·Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Eric Jones
Teacher: Mr. Rivera
Class: 9:10
School: Hamilton Jr. High
Date of Testing: 11-20-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	Percentiles School	Percentiles State
SKILLS				
Procedures	213	36	23	23
Knowledge	215	28	23	24
Problem Solving	246	64	47	47
TOPICS				
Numbers	208	21	19	20
Algebra	235	62	38	38
Geometry	228	39	34	33
Measurement	232	51	38	36
Statistics	269	76	71	65

Overall math score	231 ± 22
Class Percentile	45
School Percentile	32
State Percentile	31

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

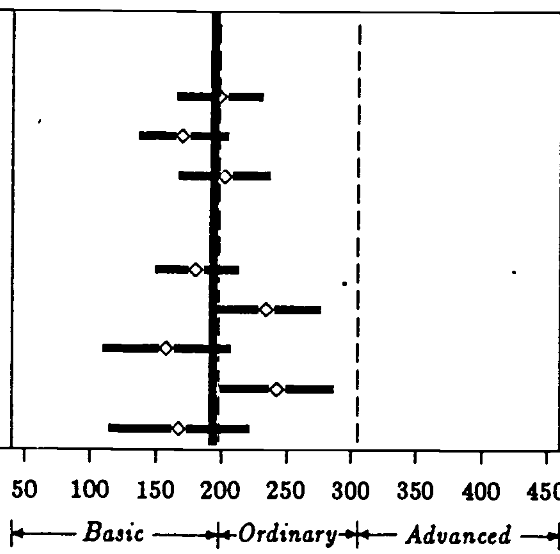
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Robert Cobden
Teacher: Mr. Rivera
Class: 9:55
School: Hamilton Jr. High
Date of Testing: 11-20-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	School	State
SKILLS				
Procedures	198	20	15	15
Knowledge	170	6	4	5
Problem Solving	202	18	16	17
TOPICS				
Numbers	181	12	8	9
Algebra	235	41	39	38
Geometry	158	4	4	3
Measurement	243	65	46	44
Statistics	168	6	7	5

Overall math score 194 ± 19
Class Percentile 8
School Percentile 8
State Percentile 8

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

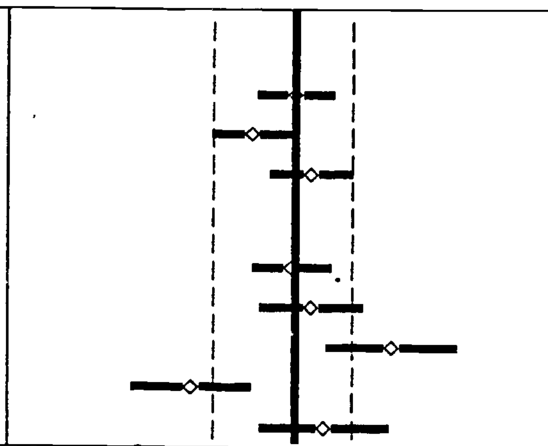
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Laura Williams
Teacher: Thomas Tucker
Class: 9:55
School: Hamilton Jr. High
Date of Testing: 11-20-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	School	State
SKILLS				
Procedures	262	88	61	60
Knowledge	228	43	32	33
Problem Solving	274	80	69	68
TOPICS				
Numbers	259	77	55	57
Algebra	274	69	70	68
Geometry	336	99	94	96
Measurement	181	14	9	8
Statistics	284	83	80	75

Scale Score: 50 100 150 200 250 300 350 400 450

Mastery Level: |← *Basic* →|← *Ordinary* →|← *Advanced* →|

Overall math score: 262 ± 18

Class Percentile: 83

School Percentile: 64

State Percentile: 62

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

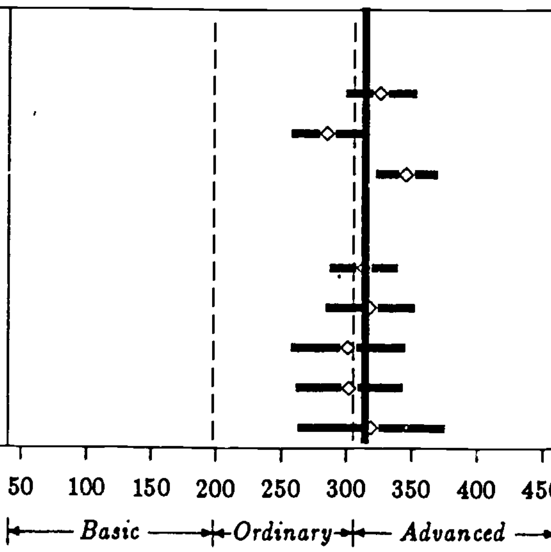
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Steve Marcus
Teacher: Cindy Caldwell
Class: 10:40
School: Hamilton Jr. High
Date of Testing: 11-20-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	School	State
SKILLS				
Procedures	326	73	95	94
Knowledge	285	43	77	76
Problem Solving	346	85	97	97
TOPICS				
Numbers	313	74	88	90
Algebra	318	78	92	91
Geometry	301	52	82	85
Measurement	302	55	87	85
Statistics	319	78	94	92

Scale Score
Mastery Level
Overall math score: 314 ± 17
Class Percentile: 76
School Percentile: 95
State Percentile: 95

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

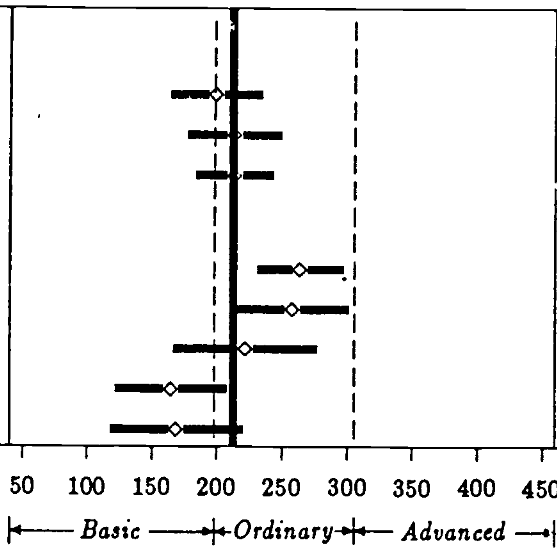
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Thomas Williams
Teacher: John Wilson
Class: 9:15
School: Whitesboro Elem.
Date of Testing: 11-11-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	School	State
SKILLS				
Procedures	198	37	31	15
Knowledge	212	57	43	22
Problem Solving	212	56	40	22
TOPICS				
Numbers	262	85	80	60
Algebra	256	78	71	54
Geometry	[illegible]0	[illegible]8	47	28
Measurement	163	11	6	4
Statistics	167	16	8	5

Overall math score: 211 ± 19
Class Percentile: 51
School Percentile: 35
State Percentile: 16

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

Survey Test of Grade 8 Mathematics

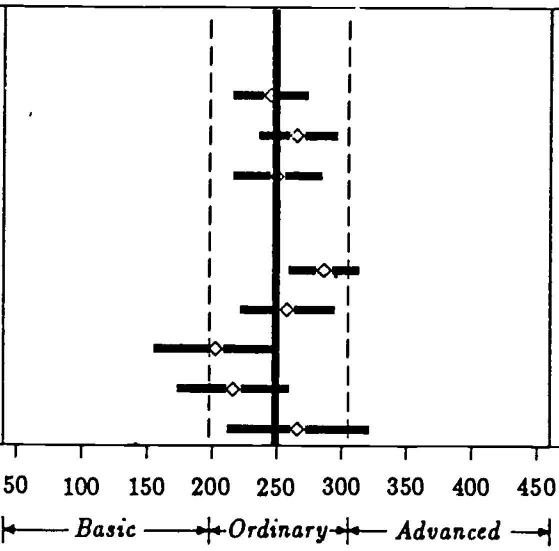
STUDENT REPORT

Student: James Hopper
Teacher: Tom Barnes
Class: 9:15
School: Whitesboro Elem.
Date of Testing: 11-11-86

Your personal Math achievement profile

Scale score profile and confidence intervals

	Profile Score	Percentiles Class	School	State
SKILLS				
Procedures	242	81	75	43
Knowledge	263	87	86	61
Problem Solving	247	79	72	48
TOPICS				
Numbers	283	94	90	75
Algebra	255	73	71	54
Geometry	200	34	28	16
Measurement	214	43	48	24
Statistics	264	77	83	61



Scale Score
Mastery Level
Overall math score: 246 ± 18
Class Percentile: 85
School Percentile: 80
State Percentile: 46

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

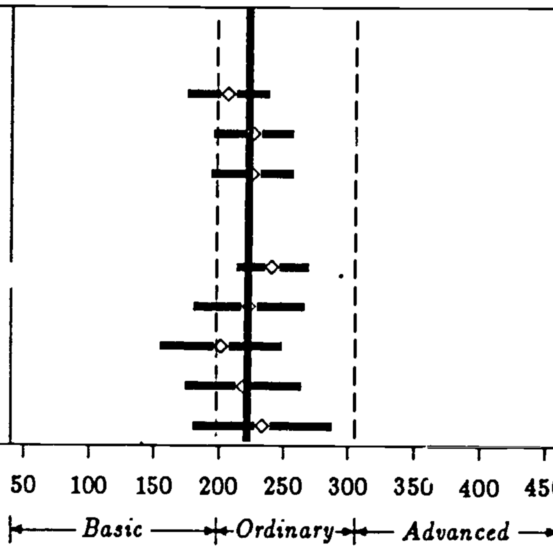
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Chris Stewart
Teacher: Susan Smith
Class: 9:15
School: Whitesboro Elem.
Date of Testing: 11-11-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	School	State
SKILLS				
Procedures	204	42	36	18
Knowledge	224	48	55	30
Problem Solving	223	53	50	29
TOPICS				
Numbers	239	68	64	41
Algebra	221	43	39	28
Geometry	200	34	27	16
Measurement	217	45	51	25
Statistics	232	49	57	36

Overall math score	220 ± 18
Class Percentile	47
School Percentile	47
State Percentile	22

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

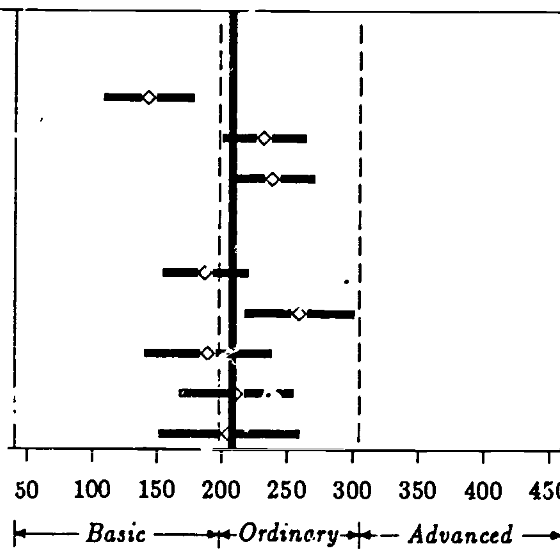
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Susan Gray
Teacher: John Wilson
Class: 9:15
School: Whitesboro Elem.
Date of Testing: 11-11-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	School	State
SKILLS				
Procedures	143	1	2	2
Knowledge	232	73	63	36
Problem Solving	239	79	65	41
TOPICS				
Numbers	187	30	22	10
Algebra	259	81	74	57
Geometry	189	26	19	11
Meas[illegible]ent	211	52	44	22
Sta[illegible]	205	46	32	18

Scale Sc[illegible]
Mastery Level
Overall math score: 208 ± 19
Class Percentile: 46
School Percentile: 31
State Percentile: 14

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

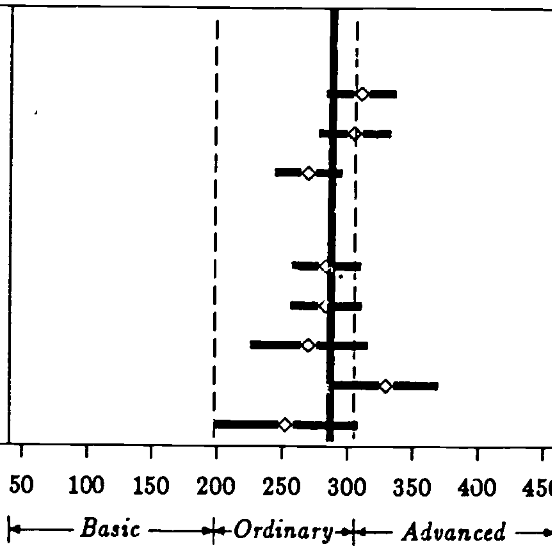
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Terry Jones
Teacher: Bill Stevens
Class: 9:13
School: Sanderson
Date of Testing: 11-11-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	School	State
SKILLS				
Procedures	308	78	73	88
Knowledge	303	83	69	85
Problem Solving	268	50	43	64
TOPICS				
Numbers	282	58	54	74
Algebra	282	67	53	74
Geometry	269	56	46	65
Measurement	329	96	88	94
Statistics	252	46	41	52

Overall math score	286 ± 17
Class Percentile	76
School Percentile	61
State Percentile	82

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

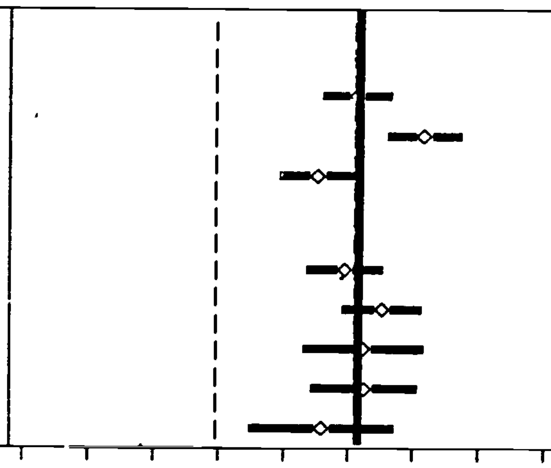
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Steven Livingston
Teacher: Martha Thomas
Class: 8:22
School: Sanderson
Date of Testing: 11-11-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	Percentiles School	Percentiles State
SKILLS				
Procedures	305	57	71	86
Knowledge	357	83	93	98
Problem Solving	275	37	48	69
TOPICS				
Numbers	296	54	66	82
Algebra	325	67	81	93
Geometry	311	59	72	89
Measurement	312	67	80	89
Statistics	279	54	61	72

Scale Score: 50 100 150 200 250 300 350 400 450
Mastery Level: *Basic* | *Ordinary* | *Advanced*
Overall math score: 307 ± 17
Class Percentile: 63
School Percentile: 79
State Percentile: 93

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

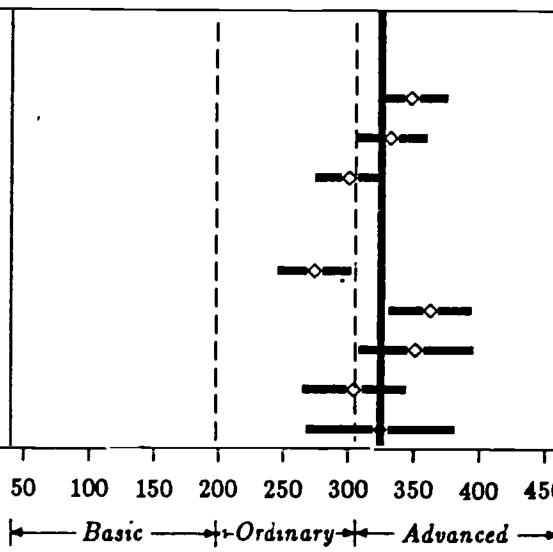
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Bill Johnson
Teacher: Mary White
Class: 8:22
School: Sanderson
Date of Testing: 11-11-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	Percentiles School	Percentiles State
SKILLS				
Procedures	346	85	92	97
Knowledge	330	69	84	94
Problem Solving	298	52	66	83
TOPICS				
Numbers	271	34	45	66
Algebra	360	85	94	99
Geometry	349	79	88	98
Measurement	302	60	74	85
Statistics	322	83	87	93

Overall math score	322 ± 17
Class Percentile	74
School Percentile	88
State Percentile	97

EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

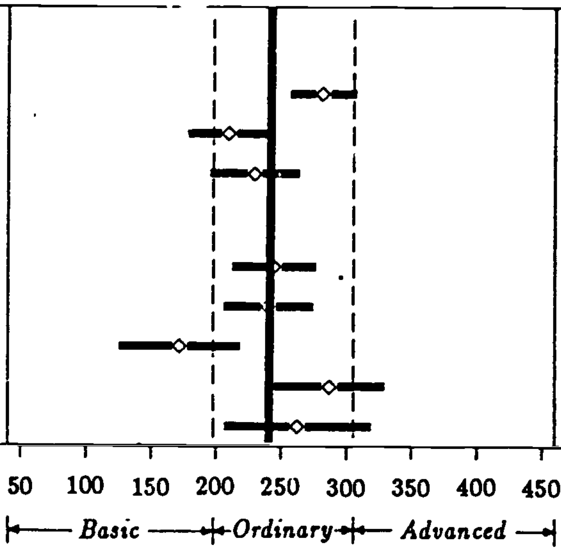
Survey Test of Grade 8 Mathematics

STUDENT REPORT

Student: Susan Jones
Teacher: Bill Stevens
Class: 9:13
School: Sanderson
Date of Testing: 11-11-86

Your personal Math achievement profile

Scale score profile and confidence intervals



	Profile Score	Percentiles Class	School	State
SKILLS				
Procedures	280	57	52	72
Knowledge	208	14	10	20
Problem Solving	228	16	17	33
TOPICS				
Numbers	243	24	24	44
Algebra	239	30	24	42
Geometry	171	6	5	6
Measurement	286	74	62	77
Statistics	262	53	48	60

Scale Score
Mastery Level
Overall math score: 240 ± 18
Class Percentile: 22
School Percentile: 20
State Percentile: 40

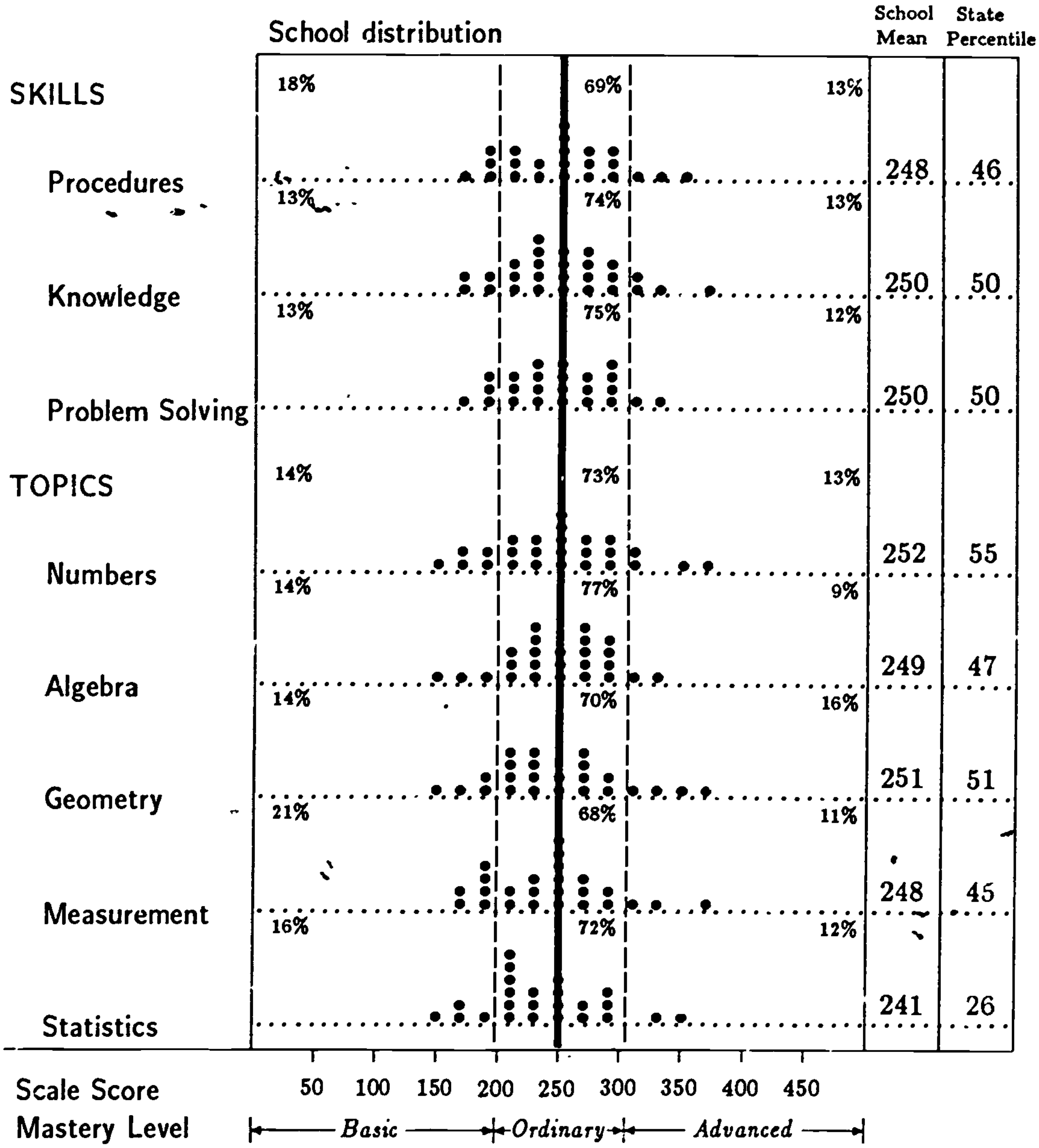
EXPLANATION:

Your scores for five areas of mathematics are shown in the graph above. Each bar on the graph has a 2/3 chance of including your true score. The diamond marks the best estimate of your true score. Scores toward the right hand side of the graph indicate relative strength in the mathematics skill or topic. Scores toward the left indicate relative weakness. The heavy black verticle line marks your overall average score in mathematics. The overall math score, and the class, school, and state percentiles corresponding to it, are shown below the graph.

Survey Test of Grade 8 Mathematics

SCHOOL REPORT

School: Hamilton Jr. High
Date of Testing: 11-20-86
Number of Students Tested: 76



Overall math score 249
State Percentile 48

EXPLANATION: Each • represents about three students. The heavy black vertical line marks the overall average score of the school in mathematics.

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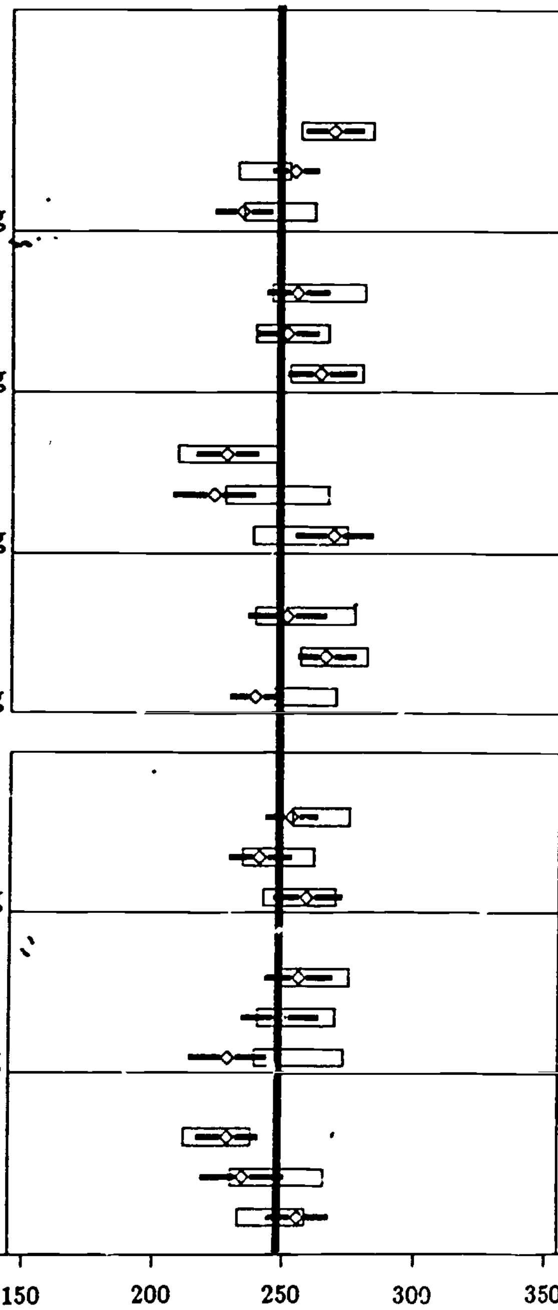
SCHOOL REPORT (page 2)

School performance on curricular objectives

Objective profile (◇), confidence intervals (—◇—) and comparison bands (▭)



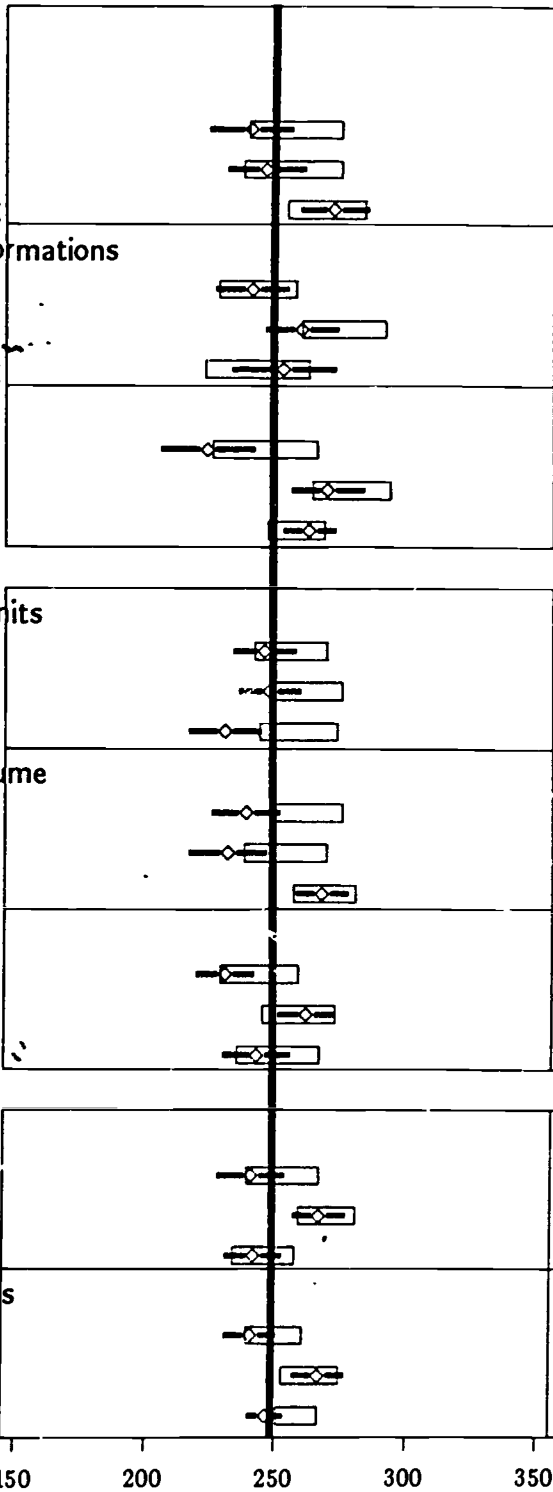
Objective	Scale Score	State %tile	Percent Correct
1. NUMBERS			
Integers			
Procedures	270	79	58
Knowledge	255	76	64
Problem Solving	235	23	54
Fractions			
Procedures	256	50	51
Knowledge	252	66	57
Problem Solving	265	67	49
Percent			
Procedures	229	46	43
Knowledge	224	15	41
Problem Solving	270	76	50
Decimals			
Procedures	252	47	55
Knowledge	267	76	68
Problem Solving	240	38	59
2. ALGEBRA			
Expressions			
Procedures	254	65	55
Knowledge	242	41	39
Problem Solving	260	67	43
Equations			
Procedures	257	54	46
Knowledge	250	34	45
Problem Solving	230	16	38
Functions			
Procedures	[illegible]	64	47
Knowledge	236	16	25
Problem Solving	257	77	41

Overall math score 249

Procedures: Calculating, rewriting, constructing, estimating.
Knowledge: Terms, definitions, concepts, principles.
Problem Solving: Proof, reasoning, real-world applications.

SCHOOL REPORT (page 3)

Objective profile (◇), confidence intervals (—◇—) and comparison bands (▭)



	Scale Score	State %tile	Percent Correct
3. GEOMETRY			
Figures			
Procedures	240	40	38
Knowledge	246	43	45
Problem Solving	272	90	53
Relations & transformations			
Procedures	241	55	44
Knowledge	260	42	43
Problem Solving	253	51	36
Coordinates			
Procedures	224	17	32
Knowledge	270	73	43
Problem Solving	263	66	45
4. MEASUREMENT			
English & metric units			
Procedures	246	60	43
Knowledge	248	54	43
Problem Solving	231	17	29
Length, area & volume			
Procedures	239	27	34
Knowledge	232	7	27
Problem Solving	268	79	58
Angular measure			
Procedures	231	43	38
Knowledge	262	68	46
Problem Solving	243	36	32
5. STATISTICS			
Probability			
Procedures	241	10	29
Knowledge	267	60	59
Problem Solving	242	29	41
Descriptive statistics			
Procedures	241	18	33
Knowledge	267	38	50
Problem Solving	247	35	46

Scale Score 150 200 250 300 350

Overall math score 249

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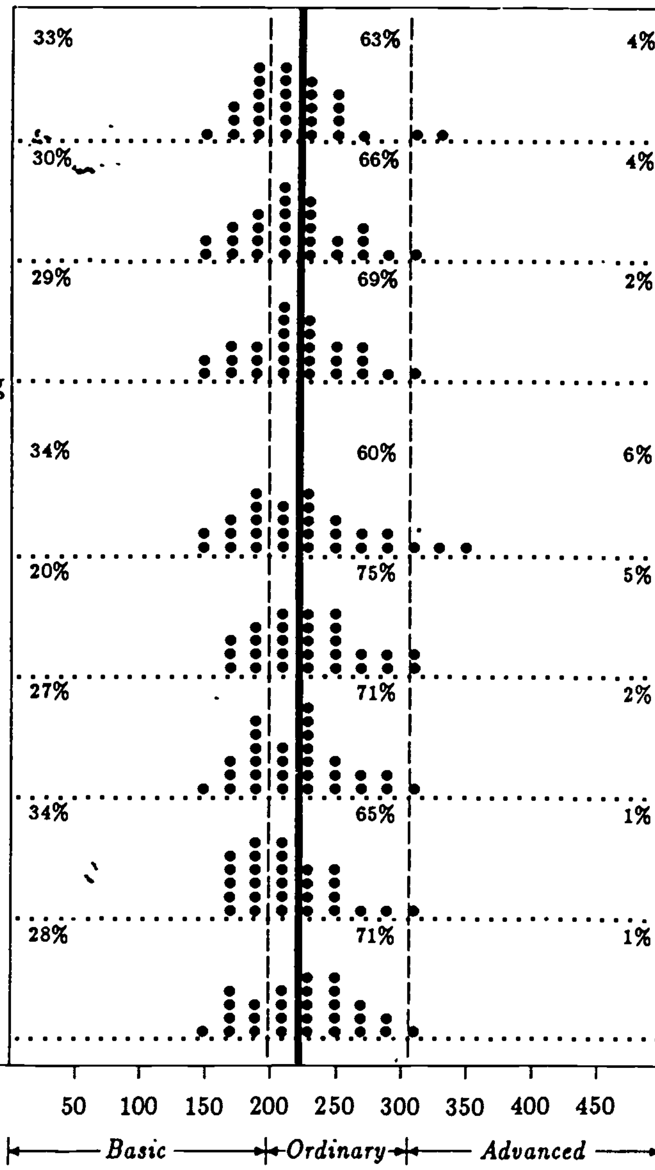
Survey Test of Grade 8 Mathematics

SCHOOL REPORT

School: Whitesboro Elem.
Date of Testing: 11-11-86
Number of Students Tested: 83

School distribution



	Basic	Ordinary	Advanced	School Mean	State Percentile
SKILLS					
Procedures	33%	63%	4%	217	5
Knowledge	30%	66%	4%	219	3
Problem Solving	29%	69%	2%	223	5
TOPICS					
Numbers	34%	60%	6%	223	6
Algebra	20%	75%	5%	233	12
Geometry	27%	71%	2%	223	4
Measurement	34%	65%	1%	216	3
Statistics	28%	71%	1%	225	3

Overall math score 222
State Percentile 4

EXPLANATION: Each • represents about three students. The heavy black vertical line marks the overall average score of the school in mathematics.

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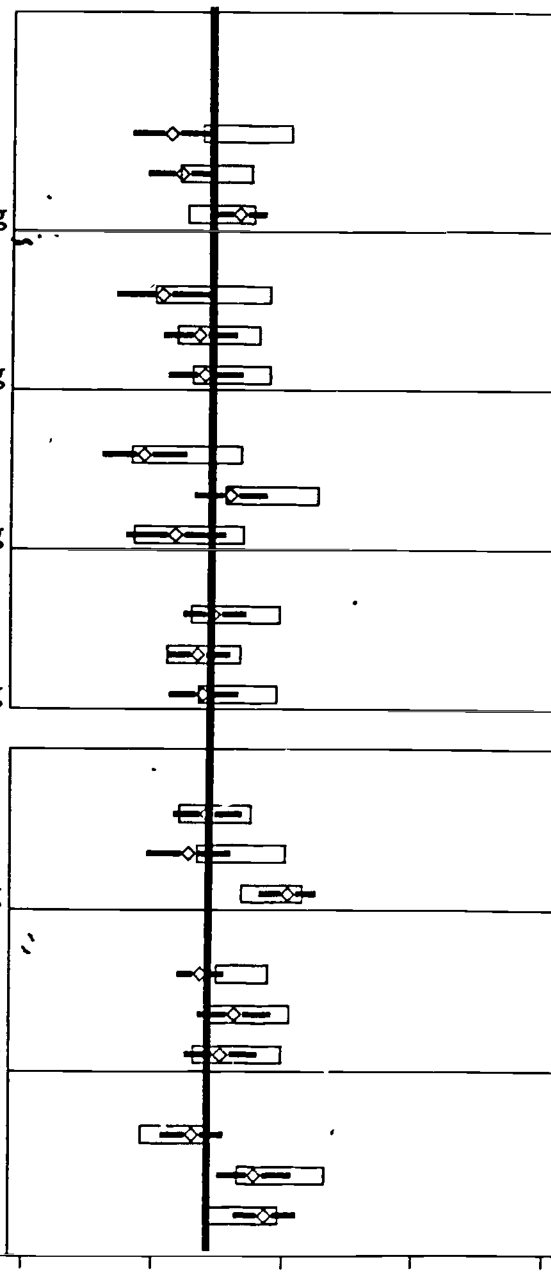
SCHOOL REPORT (page 2)

School performance on curricular objectives

Objective profile (◇), confidence intervals (—◇—) and comparison bands (▭)



Objective	Scale Score	State %tile	Percent Correct
1. NUMBERS			
Integers			
Procedures	206	3	43
Knowledge	210	5	54
Problem Solving	232	18	55
Fractions			
Procedures	203	6	31
Knowledge	217	9	43
Problem Solving	219	5	37
Percent			
Procedures	196	13	36
Knowledge	229	21	42
Problem Solving	208	8	30
Decimals			
Procedures	223	11	46
Knowledge	217	6	53
Problem Solving	219	9	49
2. ALGEBRA			
Expressions			
Procedures	221	12	42
Knowledge	214	6	27
Problem Solving	252	42	43
Equations			
Procedures	219	7	39
Knowledge	232	10	45
Problem Solving	227	12	35
Functions			
Procedures	216	26	45
Knowledge	240	22	30
Problem Solving	244	48	40

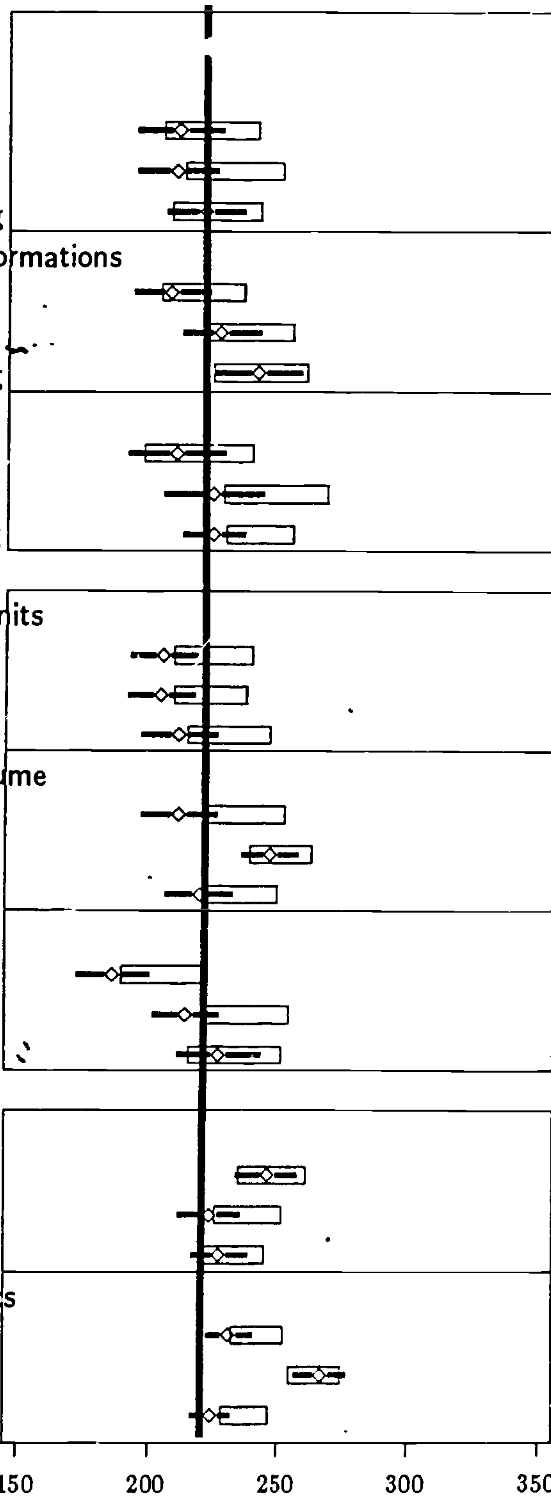
Scale Score: 150 200 250 300 350

Overall math score: 222

Procedures: Calculating, rewriting, constructing, estimating.
Knowledge: Terms, definitions, concepts, principles.
Problem Solving: Proof, reasoning, real-world appl ions.

SCHOOL REPORT (page 3)

Objective profile (◇), confidence intervals (—◇—) and comparison bands (▭)



	Scale Score	State %tile	Percent Correct
3. GEOMETRY			
Figures			
Procedures	212	8	30
Knowledge	211	4	31
Problem Solving	222	8	35
Relations & transformations			
Procedures	209	5	27
Knowledge	228	5	35
Problem Solving	242	29	25
Coordinates			
Procedures	211	8	23
Knowledge	225	8	28
Problem Solving	225	5	36
4. MEASUREMENT			
English & metric units			
Procedures	206	6	25
Knowledge	205	2	22
Problem Solving	212	3	27
Length, area & volume			
Procedures	212	4	24
Knowledge	247	35	40
Problem Solving	220	3	30
Angular measure			
Procedures	187	1	16
Knowledge	215	4	29
Problem Solving	228	11	20
5. STATISTICS			
Probability			
Procedures	247	22	24
Knowledge	225	3	33
Problem Solving	229	7	31
Descriptive statistics			
Procedures	233	6	39
Knowledge	268	41	51
Problem Solving	226	4	35

Scale Score: 150 200 250 300 350

Overall math score 222

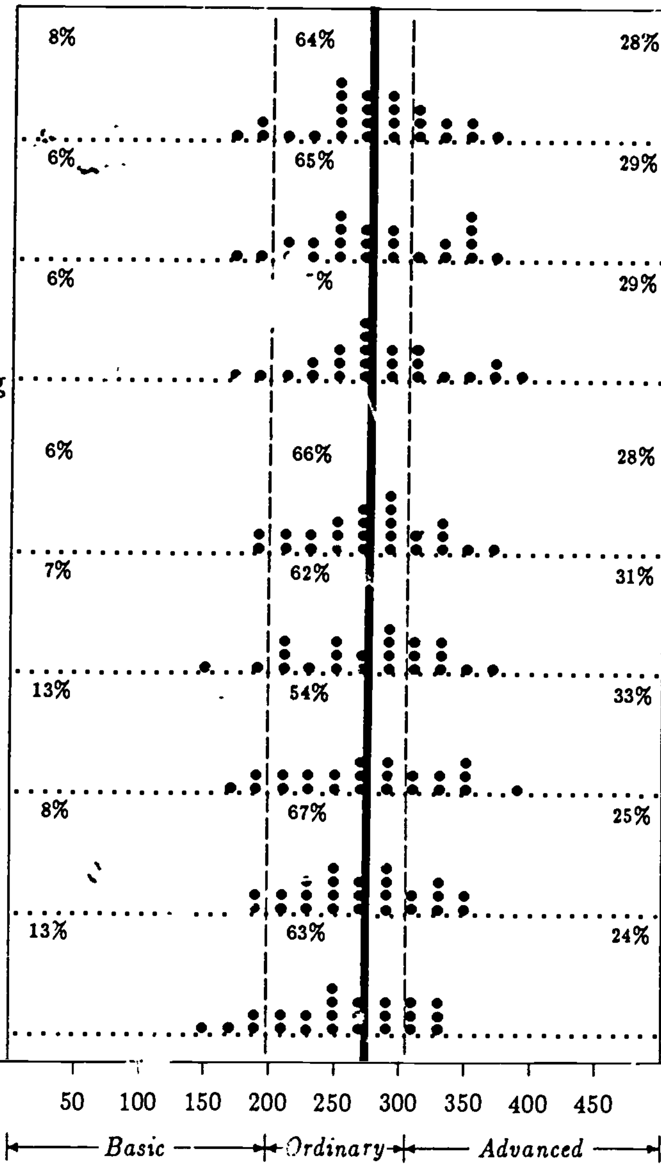
NORC *The University of Chicago*

Survey Test of Grade 8 Mathematics

SCHOOL REPORT

School: Sanderson
Date of Testing: 11-11-86
Number of Students Tested: 72

School distribution



	School Mean	State Percentile
SKILLS		
Procedures	277	91
Knowledge	276	94
Problem Solving	277	95
TOPICS		
Numbers	276	93
Algebra	278	97
Geometry	275	95
Measurement	271	88
Statistics	264	84

Scale Score
Mastery Level
Overall math score 274
State Percentile 94

EXPLANATION: Each • represents about three students. The heavy black vertical line marks the overall average score of the school in mathematics.

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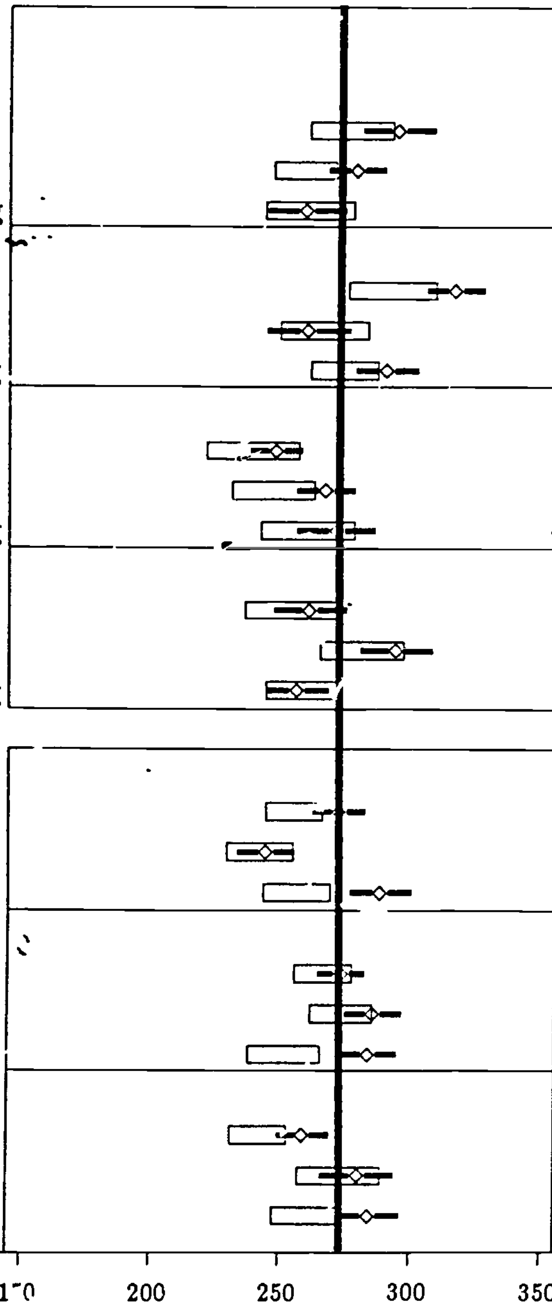
SCHOOL REPORT (page 2)

School performance on curricular objectives

Objective profile (◇), confidence intervals (—◇—) and comparison bands (▭)



	Scale Score	State %tile	Percent Correct
1. NUMBERS			
Integers			
Procedures	296	97	64
Knowledge	280	98	72
Problem Solving	261	78	60
Fractions			
Procedures	318	97	81
Knowledge	262	82	58
Problem Solving	292	95	63
Percent			
Procedures	250	71	53
Knowledge	269	80	61
Problem Solving	273	79	46
Decimals			
Procedures	263	64	56
Knowledge	296	98	79
Problem Solving	258	73	67
2. ALGEBRA			
Expressions			
Procedures	274	91	69
Knowledge	246	48	42
Problem Solving	290	100	58
Equations			
Procedures	275	80	49
Knowledge	287	93	58
Problem Solving	285	99	58
Functions			
Procedures	260	99	53
Knowledge	281	93	38
Problem Solving	285	99	64

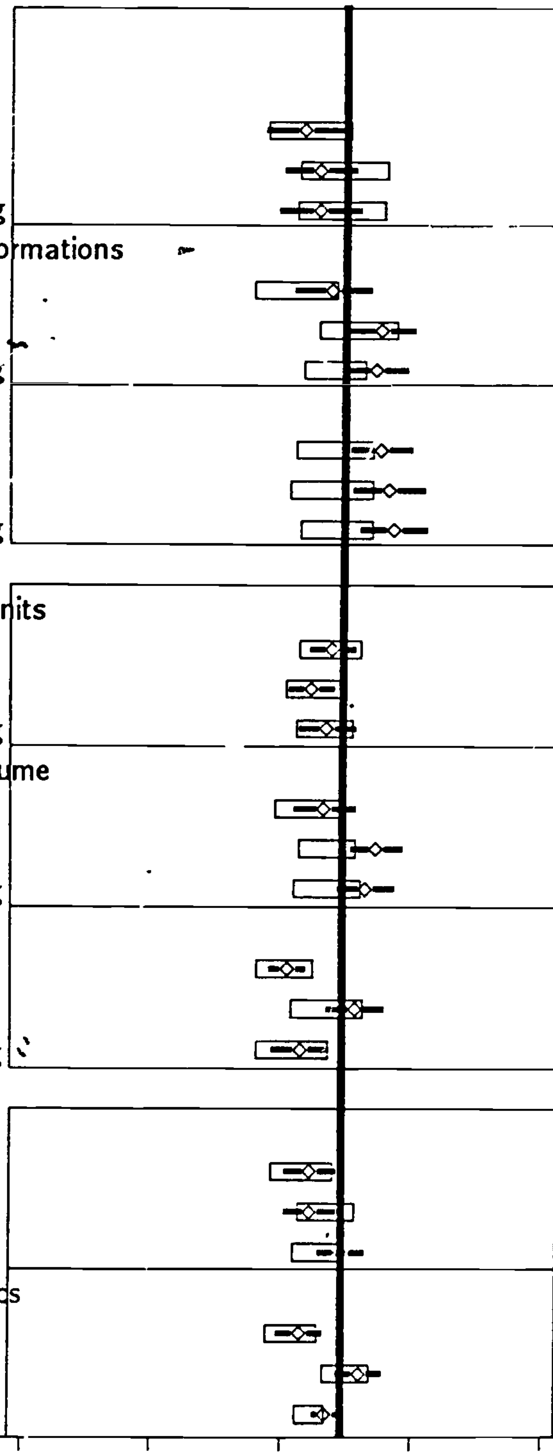
Scale Score

Overall math score 274

Procedures: Calculating, rewriting, constructing, estimating.
Knowledge: Terms, definitions, concepts, principles.
Problem Solving: Proof, reasoning, real-world applications.

SCHOOL REPORT (page 3)

Objective profile (◇), confidence intervals (—◇—) and comparison bands (▭)



	Scale Score	State %tile	Percent Correct
3. GEOMETRY			
Figures			
Procedures	258	69	49
Knowledge	264	73	49
Problem Solving	264	80	49
Relations & transformations			
Procedures	269	95	54
Knowledge	288	84	57
Problem Solving	286	96	39
Coordinates			
Procedures	288	89	54
Knowledge	291	94	51
Problem Solving	293	98	57
4. MEASUREMENT			
English & metric units			
Procedures	270	91	54
Knowledge	262	78	49
Problem Solving	268	81	40
ength, area & volume			
Procedures	267	70	44
Knowledge	287	100	54
Problem Solving	283	95	57
Angular measure			
Procedures	253	74	43
Knowledge	279	89	50
Problem Solving	258	70	40
5. STATISTICS			
Probability			
Procedures	262	69	44
Knowledge	262	50	58
Problem Solving	274	95	51
Descriptive statistics			
Procedures	258	66	43
Knowledge	281	81	60
Problem Solving	268	84	63

Scale Score 150 200 250 300 350

Overall math score 274

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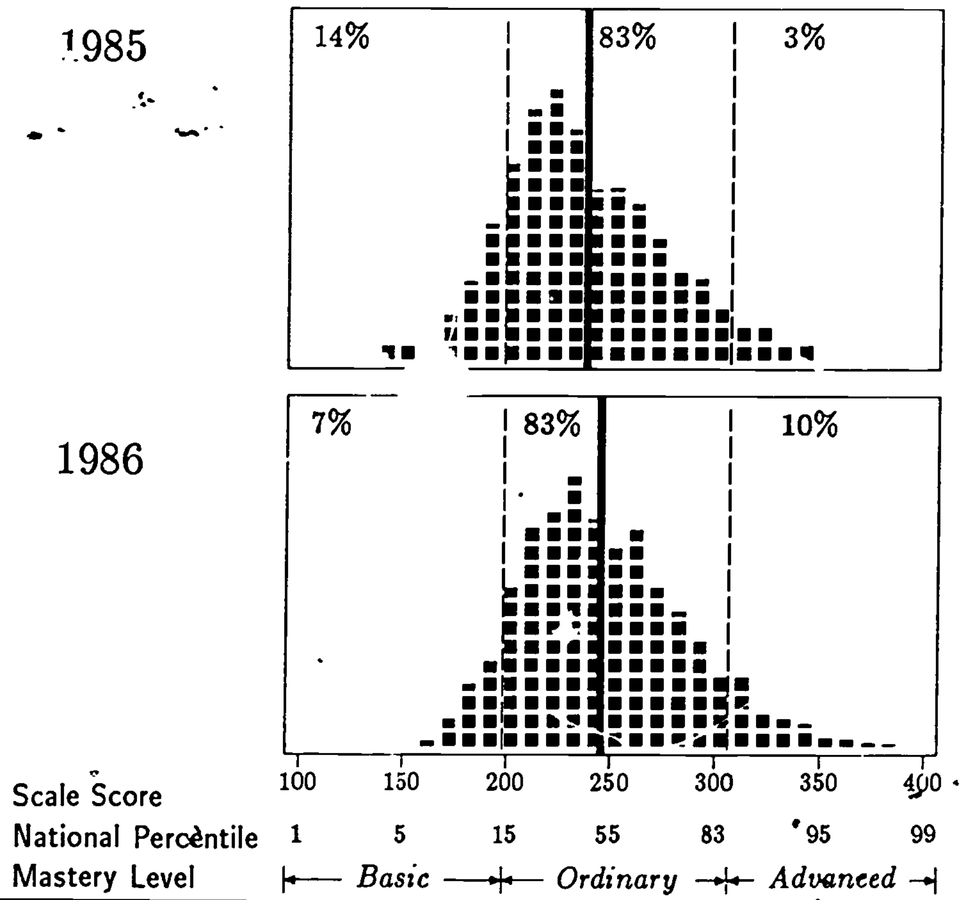
STATE SUMMARY

Mathematics scores of 8th Grade Students in 1985 and 1986



EXPLANATION:

Overall mathematics attainment of 8th grade students in December of 1985 and 1986. Each box (■) represents 1000 students. The heavy line (I) is the median score for each yea.

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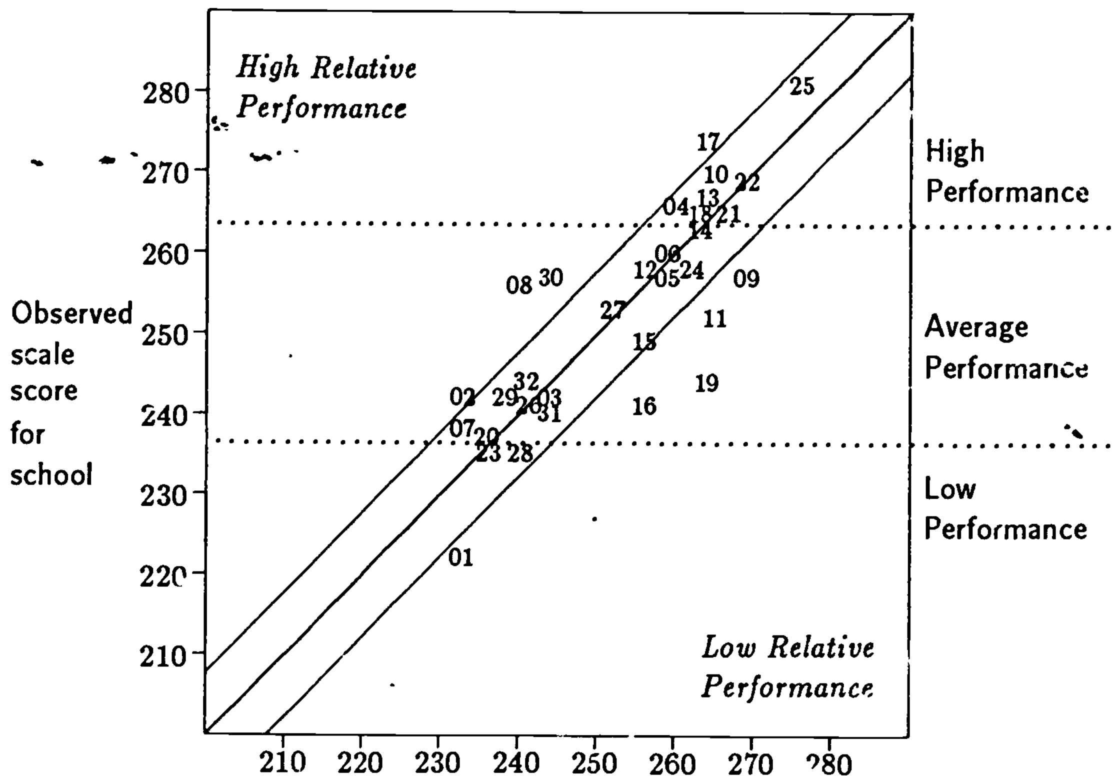
STATE SUMMARY

School Performance Chart
8th Grade Mathematics



Scale score expected for school based on community characteristics and resources.

EXPLANATION:

The location of schools on the performance chart is indicated by their identification codes. *Absolute* performance levels are given by the positions of the schools on the scale on the left. Performance *relative* to other schools with the same community characteristics and resources is indicated by the vertical distance of the school code from the heavy diagonal line. Schools located above the upper light diagonal line are performing better than expected. Those below the lower light diagonal line are performing less well than expected.

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III. Item Parameter Estimates

FORM 1

ITEM PARAMETER ESTIMATES
EIGHT SUBTESTS

Numbers Subtest (27 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.538	0.068	-1.934	0.253	0.106	0.047
E2	0.333	0.054	-1.104	0.186	0.116	0.036
E3	0.374	0.067	0.755	0.146	0.129	0.023
E4	0.608	0.096	0.601	0.112	0.108	0.022
E5	0.402	0.060	-0.503	0.083	0.109	0.032
E6	0.847	0.094	-0.630	0.090	0.089	0.033
E7M	0.824	0.071	0.453	0.055	0.099	0.013
E8	1.431	0.228	0.561	0.125	0.051	0.018
E9M	0.302	0.039	0.851	0.115	0.125	0.015
E10M	0.755	0.057	0.349	0.043	0.070	0.014
E11	1.228	0.139	1.018	0.149	0.048	0.014
E12M	0.386	0.039	-1.143	0.120	0.112	0.025
M10	0.265	0.046	4.302	0.763	0.117	0.009
M2D	0.808	0.060	-0.091	0.033	0.091	0.018
M3	0.570	0.060	-0.126	0.041	0.089	0.0[illegible]
M4D	0.834	0.059	-0.030	0.033	0.087	0.018
M5	0.257	0.044	0.929	0.166	0.135	0.020
M6D	0.716	0.050	0.601	0.054	0.104	0.014
M8D	0.891	0.060	0.621	0.056	0.130	0.013
M11	0.631	0.061	-0.934	0.100	0.102	0.030
D3	0.440	0.049	1.686	0.195	0.104	0.019
D5	0.310	0.043	-0.061	0.041	0.115	0.029
D7	0.861	0.067	0.750	0.078	0.079	0.021
D9	1.110	0.056	1.737	0.115	0.042	0.012
D10	0.760	0.053	1.762	0.139	0.074	0.014
D11	0.511	0.066	-0.039	0.044	0.114	0.029
D12	0.635	0.063	0.505	0.069	0.109	0.024

Algebra Subtest (22 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E13	0.727	0.114	0.294	0.074	0.125	0.026
E14	0.444	0.075	0.780	0.144	0.160	0.024
E15	0.401	0.070	0.442	0.094	0.162	0.027
E16	0.735	0.092	-1.938	0.255	0.127	0.057
E17M	0.526	0.046	-1.022	0.095	0.130	0.025
E18	0.781	0.124	0.349	0.082	0.116	0.026
E19	0.649	0.100	0.453	0.090	0.123	0.025
E20M	0.560	0.083	2.808	0.425	0.142	0.003
E21M	0.434	0.054	1.251	0.[illegible]61	0.171	0.013
M13	1.127	0.098	-0.494	0.068	0.116	0.026
M14D	1.276	0.104	-0.066	0.040	0.082	0.017
M15	0.561	0.147	3.792	1.015	0.093	0.009
M16D	1.124	0.089	-0.069	0.038	0.104	0.017
M18	0.812	0.089	0.213	0.052	0.120	0.018
M19	0.424	0.048	-1.037	0.125	0.135	0.030
D13	0.645	0.082	-0.015	0.048	0.151	0.029
D15	1.588	0.112	0.840	0.101	0.102	0.019
D17	1.206	0.059	1.805	0.121	0.042	0.013
D18	0.669	0.062	0.959	0.103	0.133	0.021
D19	0.83[illegible]	0.060	1.977	0.165	0.104	0.015
D20	0.552	0.057	2.308	0.252	0.124	0.016
D21	0.719	0.070	0.247	0.054	0.130	0.026

Geometry Subtest (25 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E22	0.504	0.085	-0.277	0.070	0.137	0.033
E23M	0.596	0.065	0.391	0.055	0.128	0.017
E24	0.445	0.081	0.313	0.078	0.141	0.028
E25	0.570	0.094	0.700	0.129	0.122	0.024
E26	0.713	0.112	-0.928	0.158	0.136	0.041
E27	0.445	0.095	2.409	0.523	0.127	[illegible]
E28	0.433	0.081	1.335	0.256	0.140	[illegible]
E29	0.509	0.092	1.044	0.199	0.135	0.023
E30	0.464	0.086	0.936	0.183	0.148	0.023
M22	0.601	0.085	-0.401	0.070	0.129	0.027
M24	0.416	0.073	2.121	0.379	0.136	0.014
M25	0.572	0.082	0.852	0.131	0.132	0.018
M26	0.483	0.073	0.131	0.045	0.140	0.023
M27D	0.459	0.056	2.272	0.283	0.139	0.010
M28	0.816	0.069	-2.17[illegible]	0.198	0.137	0.055
M29	0.370	0.073	2.008	0.405	0.178	0.016
M30	0.404	0.063	0.256	0.056	0.146	0.022
D22	0.716	0.092	0.521	0.086	0.125	0.021
D23	0.400	0.060	-1.548	0.237	0.147	0.040
D24	0.524	0.071	0.057	0.047	0.142	0.026
D25	0.548	0.072	2.163	0.294	0.096	0.015
D26	0.771	0.109	0.143	0.059	0.134	0.025
D28	0.681	0.093	0.351	0.070	0.127	0.023
D29	0.611	0.073	1.290	0.166	0.123	0.017
D30	0.642	0.083	0.497	0.083	0.131	0.023

Measurement Subtest (23 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E31M	0.806	0.071	0.598	0.066	0.085	0.013
E32	0.397	0.083	1.073	0.231	0.141	0.022
E33	0.380	0.075	0.867	0.179	0.140	0.024
E34M	0.615	0.062	0.719	0.082	0.126	0.014
E35	0.959	0.133	0.906	0.148	0.077	0.019
E36	0.426	0.072	-0.7[illegible]9	0.130	0.134	0.035
E37	0.530	0.127	2.[illegible]91	0.729	0.088	0.013
E38	0.528	0.099	0.364	0.088	0.132	0.025
E39	0.389	0.120	3.517	1.095	0.153	0.015
M32	0.465	0.065	1.835	0.265	0.118	0.014
M33	0.985	0.128	0.030	0.049	0.090	0.022
M35	0.378	0.067	2.143	0.383	0.179	0.015
[illegible]	0.755	0.073	-0.274	0.042	0.110	0.020
[illegible]	0.453	0.046	0.079	0.030	0.123	0.018
M38	0.415	0.059	0.892	0.134	0.142	0.019
M39	0.354	0.107	4.905	1.495	0.098	0.010
D31	0.448	0.066	1.057	0.164	0.148	0.021
D32	0.525	0.064	1.3[illegible]1	0.175	0.118	0.019
D33	0.590	0.067	2.130	0.253	0.111	0.015
D34	0.653	0.071	1.489	0.174	0.120	0.017
D35	0.763	0.074	1.283	0.140	0.103	0.018
D38	0.439	0.060	1.003	0.145	0.135	0.022
D39	0.811	0.097	0.756	0.107	0.118	0.021

Probability and Statistics Subtest (16 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.	
E40	0.452	0.109	2.358	0.574	0.128	0.017	
E41	0.478	0.087	-1.132	0.213	0.135	0.040	
E42M	0.662	0.073	0.734	0.090	0.122	0.014	
E43	0.525	0.109	-0.019	0.053	0.126	0.030	**
E44	0.516	0.089	-2.560	0.448	0.132	0.058	
E45	0.720	0.171	0.133	0.066	0.118	0.027	
M40	0.426	0.090	3.916	0.835	0.085	0.010	*
M41	0.742	0.089	-0.965	0.126	0.124	0.035	*
M43	0.705	0.087	0.667	0.095	0.108	0.019	
M44	0.460	0.069	1.698	0.263	0.146	0.016	
M45D	0.653	0.067	0.800	0.090	0.135	0.014	*
D40	0.746	0.098	[illegible]	0.183	0.125	0.045	
D41	0.751	0.152	-0.000	0.052	0.118	0.027	
D42	0.502	0.088	2.572	0.458	0.123	0.014	
D43	0.514	0.087	0.938	0.167	0.137	0.021	
D44	0.436	0.102	3.195	0.758	0.104	0.015	

Procedural Skills Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.	
E1	0.488	0.068	-2.082	0.297	0.105	0.047	
E4	0.620	0.110	0.547	0.114	0.110	0.022	
E7M	0.529	0.059	0.583	0.065	0.095	0.014	
E10M	0.755	0.058	0.391	0.045	0.075	0.014	
E13	0.638	0.091	-0.115	0.054	0.093	0.027	
E16	0.471	0.071	-2.925	0.446	0.105	0.055	
E19	0.585	0.094	0.065	0.053	0.098	0.026	
E22	0.437	0.068	-0.674	0.116	0.107	0.033	
E25	0.460	0.076	0.437	0.088	0.101	0.024	
E28	0.567	0.098	0.566	0.113	0.097	0.022	
E31M	0.695	0.057	0.554	0.057	0.081	0.013	
E34M	0.413	0.043	0.752	0.085	0.097	0.015	
E37	0.621	0.138	2.223	0.507	0.072	0.014	
E40	0.360	0.095	2.603	0.692	0.130	0.016	
E43	[illegible]	0.078	-0.281	0.068	0.104	0.030	
M1C	[illegible]	0.042	3.696	0.580	0.091	0.010	
M4D	0.808	0.062	0.059	0.033	0.116	0.016	
M13	0.778	0.071	-0.437	0.060	0.086	0.026	
M16D	0.869	0.056	-0.021	0.032	0.074	0.017	
M19	0.476	0.053	-0.892	0.108	0.107	0.030	
M22	0.410	0.048	-0.675	0.088	0.106	0.027	
M25	0.566	0.061	0.672	0.085	0.105	0.017	
M28	0.549	0.060	-2.952	0.328	0.103	0.053	
M37D	0.460	0.038	0.026	0.028	0.096	[illegible]	*
M40	0.431	0.084	3.721	0.735	0.083	0.009	
M43	0.795	0.080	0.452	0.065	0.032	0.017	
D7	0.859	0.070	0.743	0.080	0.090	0.020	
D10	0.623	0.052	1.857	0.168	0.071	0.016	
D13	0.546	0.067	-0.129	0.047	0.110	0.030	
D19	0.710	0.061	2.188	0.205	0.100	0.014	
D22	0.938	0.081	0.706	0.082	0.095	0.020	
D25	0.601	0.055	2.191	0.212	0.080	0.014	
028	0.663	0.068	0.617	0.079	0.099	0.023	
031	0.467	0.051	0.980	0.117	0.103	0.022	
034	0.544	0.052	1.649	0.166	0.090	0.017	
D40	0.851	0.127	-0.902	0.147	0.094	0.043	
D43	0.390	0.048	1.311	0.169	0.110	0.021	

Knowledge of Facts and Concepts Subtest (39 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.	
E2	0.320	0.057	-0.823	0.155	0.145	0.035	
E5	0.357	0.056	-0.240	0.061	0.132	0.031	
E8	1.065	0.116	0.953	0.130	0.056	0.018	
E11	0.611	0.088	2.270	0.341	0.089	0.014	
E14	0.394	0.063	0.577	0.106	0.129	0.025	
E17M	0.478	0.042	-1.114	0.103	0.125	0.026	
E20M	0.364	0.066	3.201	0.585	0.103	0.010	
E23M	0.476	0.050	0.296	0.045	0.127	0.016	
E26	0.730	0.085	-1.001	0.132	0.121	0.041	
E29	0.750	0.107	0.725	0.123	0.127	0.021	
E32	0.510	0.072	0.785	0.124	0.111	0.023	
E35	0.690	0.086	1.500	0.203	0.110	0.016	
E38	0.754	0.126	0.336	0.083	0.125	0.024	
E41	0.482	0.071	-1.108	0.171	0.131	0.039	
E44	0.442	0.086	-2.820	0.553	0.134	0.058	
M2D	0.843	0.070	-0.091	0.035	0.122	0.018	*
M5	0.264	0.049	1.074	0.205	0.157	0.019	
M8D	1.036	0.078	0.538	0.058	0.142	0.012	
M11	0.674	0.063	-0.951	0.099	0.117	0.031	
M14D	0.990	0.081	-0.007	0.035	0.100	0.017	
M26	0.380	0.052	-0.065	0.039	0.138	0.023	
M29	0.428	0.071	1.253	0.213	0.141	0.017	
M32	0.539	0.072	1.225	0.172	0.094	0.015	
M35	0.360	0.067	1.989	0.375	0.179	0.015	
M38	0.575	0.075	0.452	0.074	0.140	0.019	
M41	0.529	0.055	-1.432	0.155	0.131	0.035	
M44	0.352	0.066	1.782	0.339	0.143	0.016	
D5	0.320	0.048	0.025	0.042	0.143	0.029	
D11	0.519	0.067	-0.035	0.046	0.134	0.029	
D17	0.797	0.056	2.285	0.179	0.051	0.013	*
D20	0.476	0.055	2.471	0.295	0.113	0.016	
D23	0.563	0.068	-0.896	0.119	0.127	0.040	
D26	0.719	0.073	0.412	0.065	0.110	0.026	
D29	0.779	0.062	1.403	0.129	0.117	0.017	
D32	0.476	0.052	1.636	0.187	0.123	0.018	
035	0.724	0.059	1.590	0.145	0.124	0.016	
D38	0.562	0.051	0.921	0.096	0.114	0.021	
041	0.580	0.065	0.353	0.061	0.131	0.026	
D44	0.403	0.070	3.608	0.639	0.103	0.015	

Higher Level Thinking Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E3	0.396	0.083	1.134	0.245	0.177	0.022
E6	0.679	0.102	-0.454	0.087	0.134	0.033
E9M	0.438	0.050	0.787	0.096	0.152	0.015
E12M	0.475	0.049	-0.787	0.088	0.156	0.024
E15	0.456	0.085	0.238	0.070	0.164	0.027
E18	0.567	0.110	0.356	0.089	0.141	0.026
E21M	0.310	0.052	2.111	0.357	0.208	0.013
E24	0.333	0.067	0.490	0.112	0.172	0.027
E27	0.678	0.114	1.590	0.280	0.122	0.017
E30	0.565	0.107	0.706	0.147	0.155	0.023
E33	0.474	0.090	0.760	0.155	0.150	0.024
E36	0.629	0.095	-0.545	0.099	0.139	0.035
E39	0.476	0.106	2.818	0.641	0.146	0.015
E42M	0.711	0.070	0.676	0.078	0.140	0.014
E45	0.784	0.150	0.124	0.064	0.133	0.036
M3	0.542	0.065	0.096	0.042	0.136	0.022
M6D	0.817	0.060	0.620	0.059	0.138	0.013
M15	0.415	0.135	4.531	1.483	0.085	0.009
M18	0.637	0.081	0.604	0.090	0.152	0.018
M24	0.384	0.071	2.626	0.489	0.172	0.013
M27D	1.066	0.061	1.575	0.113	0.170	0.009
M30	0.353	0.051	0.319	0.060	0.163	0.022
M33	0.933	0.112	0.009	0.047	0.108	0.022
M36D	0.773	0.071	-0.231	0.039	0.139	0.020
M39	0.384	0.124	4.776	1.551	0.107	0.010
M45D	0.558	0.045	0.910	0.082	0.139	0.014
D3	0.697	0.059	1.355	0.131	0.140	0.017
D9	0.859	0.062	1.957	0.161	0.072	0.012
D12	0.634	0.068	0.412	0.066	0.143	0.024
D15	1.268	0.097	0.902	0.105	0.135	0.018
D18	0.75[illegible]	0.072	0.895	0.104	0.155	0.020
D21	0.65[illegible]	0.077	0.175	0.053	0.148	0.026
D24	0.430	0.048	0.284	0.055	0.148	0.026
D30	0.573	0.063	0.846	0.107	0.157	0.022
D33	0.648	0.064	2.203	0.232	0.130	0.014
D39	0.768	0.076	0.855	0.103	0.134	0.020
D42	0.399	0.061	3.286	0.514	0.128	0.014

* $p < .05$
** $p < .01$

FORM 2

ITEM PARAMETER ESTIMATES
EIGHT SUBTESTS

Numbers Subtest (27 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.356	0.07[illegible]	1.059	0.218	0.137	0.022
E2	0.461	0.067	-0.478	0.084	0.125	0.030
E3M	0.733	0.054	-0.832	0.070	0.116	0.024
E4	0.444	0.093	1.690	0.360	0.131	0.018
E5	0.602	0.068	-1.092	0.135	0.121	0.037
E6	0.529	0.074	-0.235	0.060	0.117	0.028
E7M	0.755	0.06[illegible]	0.999	0.091	0.074	0.011
E8	0.868	0.085	-0.738	0.094	0.130	0.032
E9M	0.541	0.054	0.854	0.092	0.109	0.013
E10	0.648	0.062	-1.917	0.195	0.[illegible]21	0.048
E11M	0.468	0.044	-0.950	0.094	0.118	0.024
E12M	0.488	0.047	-0.000	0.030	0.1[illegible]7	0.018
M1D	0.487	0.044	0.646	0.066	0.144	0.015
M2D	0.349	0.038	0.088	0.029	0.136	0.018
M4	0.730	0.083	0.289	0.053	0.093	0.020
M5	0.789	0.082	-0.722	0.087	0.114	0.030
M6D	0.725	0.047	0.927	0.069	0.079	0.012
M8	0.425	0.056	0.906	0.126	0.126	0.018
M10D	0.461	0.040	-0.856	0.080	0.113	0.024
D3	0.659	0.087	-0.303	0.063	0.126	0.031
D4	0.68[illegible]	0.094	-0.587	0.095	0.120	0.035
D5	0.471	0.051	1.323	0.153	0.118	0.019
D7	0.668	0.056	1.342	0.127	0.100	0.018
D8	1.135	0.069	1.267	0.104	0.066	0.015
D9	1.038	0.083	0.722	0.083	0.091	0.020
D11	0.637	0.075	-0.499	0.076	0.115	0.034
D12	0.4[illegible]	0.066	-0.259	0.056	0.129	0.030

Algebra Subtest (21 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E13	0.380	0.070	-0.044	0.054	0.217	0.031
E14	0.651	0.113	1.329	0.246	0.230	0.019
E15	0.900	0.131	-0.723	0.125	0.179	0.039
E16	0.693	0.105	-0.776	0.132	0.190	0.039
E17	0.571	0.081	-1.118	0.170	0.197	0.042
E18	0.601	0.103	-0.234	0.069	0.201	0.032
E19M	0.717	0.095	0.549	0.083	0.135	0.015
E20	0.626	0.098	0.799	0.140	0.164	0.024
E21	0.530	0.095	0.462	0.103	0.232	0.025
M13D	0.574	0.062	0.821	0.098	0.230	0.014
M14D	0.999	0.061	1.635	0.121	0.147	0.009
M15	0.527	0.090	-0.345	0.073	0.206	0.026
M16	0.490	0.159	3.727	1.223	0.144	0.010
M17	0.616	0.111	0.003	0.044	0.202	0.022
M18D	0.733	0.065	0.891	0.090	0.194	0.013
M20D	0.719	0.058	1.172	0.106	0.170	0.012
M21D	0.711	0.059	2.214	0.197	0.181	0.009
D15	0.798	0.099	0.256	0.066	0.199	0.026
D16	0.850	0.081	0.691	0.089	0.158	0.022
D17	0.551	0.065	2.455	0.302	0.201	0.015
D19	0.890	0.120	0.350	0.080	0.192	0.027

Geometry Subtest (26 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E22	0.582	0.084	1.284	0.048	0.101	0.024
E23	0.342	0.060	-0.045	0.218	0.134	0.035
E24	0.671	0.091	1.705	0.087	0.086	0.021
E25	0.470	0.057	-0.526	0.213	0.097	0.039
E26	0.475	0.071	1.789	0.104	0.119	0.022
E27	0.386	0.063	0.927	0.057	0.120	0.028
E28	0.620	0.086	1.713	0.090	0.112	0.021
E29M	0.412	0.041	0.913	0.058	0.115	0.014
E30	0.590	0.086	0.984	0.053	0.111	0.027
M22	0.396	0.049	0.683	0.137	0.122	0.015
M23	0.531	0.055	0.149	0.064	0.100	0.017
M24	0.801	0.081	0.089	0.065	0.092	0.016
M25	0.327	0.049	2.148	0.386	0.104	0.012
M26	0.395	0.049	1.390	0.222	0.109	0.013
M27	0.395	0.051	-0.992	0.085	0.119	0.024
M28	0.643	0.053	1.276	0.144	0.081	0.011
M30	0.485	0.061	3.451	0.489	0.062	0.007
D22	0.595	0.045	-1.391	0.101	0.177	0.024
D23	0.697	0.047	1.282	0.103	0.131	0.009
D24	0.842	0.042	1.588	0.098	0.135	0.007
D25	0.795	0.063	-0.314	0.033	0.149	0.016
D26	0.992	0.054	1.597	0.113	0.135	0.007
D27	0.827	0.058	0.937	0.085	0.170	0.010
D28	0.888	0.058	1.476	0.121	0.211	0.008
D29	1.405	0.156	-0.009	0.042	0.128	0.014
D30	0.838	0.054	1.167	0.095	0.131	0.010

Measurement Subtest (22 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E31M	0.837	0.065	0.887	0.081	0.110	0.012
E32M	0.445	0.050	0.649	0.081	0.169	0.016
E33	0.488	0.122	3.268	0.831	0.124	0.014
E34M	0.399	0.049	0.815	0.106	0.169	0.015
E35	0.616	0.117	1.442	0.285	0.163	0.0[illegible]8
E36	0.571	0.094	0.604	0.116	0.149	0.023
E37	0.527	0.108	2.290	0.480	0.159	0.016
E38	0.638	0.126	0.406	0.100	0.148	0.025
E39	0.800	0.116	1.922	0.304	0.100	0.015
M33	0.378	0.060	1.877	0.306	0.198	0.016
M35D	0.437	0.062	2.215	0.270	0.138	0.011
M36D	0.472	0.046	0.369	0.047	0.157	0.017
M37	1.244	0.212	-0.243	0.072	0.138	0.027
M38	0.931	0.080	0.885	0.093	0.115	0.016
M39	0.551	0.067	2.051	0.259	0.137	0.014
D31	0.870	0.092	0.750	0.100	0.130	0.020
D32	0.540	0.076	-0.19[illegible]	0.054	0.155	0.029
D33	0.704	0.087	0.430	0.075	0.140	0.023
D34	0.840	0.086	0.909	0.113	0.118	0.020
D37	0.605	0.069	1.638	0.197	0.119	0.017
D38	0.428	0.071	-0.185	0.055	0.170	0.029
D39	0.511	0.068	1.491	0.209	0.155	0.019

Probability and Statistics Subtest (17 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E40	0.591	0.083	1.242	0.213	0.171	0.018
E41	0.481	0.076	-0.065	0.051	0.189	0.026
E42M	0.797	0.052	0.900	0.072	0.147	0.011
E43	0.559	0.077	-0.475	0.061	0.176	0.029
E44	0.753	0.113	-0.222	0.051	0.156	0.027
E45	0.897	0.144	0.138	0.079	0.161	0.023
M40	0.399	0.049	1.344	0.165	0.207	0.014
M41	0.948	0.101	-0.526	0.077	0.188	0.026
M43	0.606	0.069	3.106	0.363	0.112	0.009
M44	0.865	0.080	0.627	0.068	0.192	0.015
M45	0.905	0.096	-0.265	0.054	0.160	0.023
D40	0.807	0.060	-1.004	0.058	0.109	0.021
D41	0.482	0.076	3.753	0.658	0.069	0.006
D42	0.520	0.045	1.099	0.128	0.110	0.010
D43	0.904	0.075	-0.072	0.038	0.087	0.013
D44	0.651	0.045	-1.826	0.108	0.103	0.029
D45	0.570	0.046	0.495	0.074	0.118	0.011

Procedural Skills Subtest (38 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.380	0.076	1.270	0.262	0.156	0.021
E4	0.459	0.096	1.954	0.417	0.145	0.017
E7M	0.928	0.066	1.259	0.105	0.142	0.010
E10	0.837	0.080	-1.511	0.162	0.136	0.049
E13	0.298	0.057	-0.430	0.096	0.162	0.032
E16	0.405	0.068	-1.3[illegible]4	0.228	0.149	0.040
E19M	0.502	0.053	0.6[illegible]9	0.076	0.160	0.015
E22	0.615	0.095	0.095	0.056	0.129	0.027
E25	0.385	0.066	-1.910	0.334	0.151	0.046
E28	0.590	0.098	0.582	0.112	0.123	0.023
E31M	0.911	0.071	0.827	0.078	0.116	0.012
E34M	0.38[illegible]	0.046	0.744	0.096	0.157	0.016
E37	0.53[illegible]	0.109	2.043	0.426	0.144	0.017
E40	0.630	0.107	0.997	0.181	0.112	0.022
E43	0.560	0.086	-0.424	0.084	0.142	0.032
M1D	0.497	0.048	0.785	0.083	0.188	0.014
M4	0.737	0.084	0.377	0.063	0.127	0.019
M10D	0.503	0.044	-0.765	0.074	0.147	0.023
M13D	0.420	0.040	0.656	0.070	0.150	0.016
M16	0.324	0.085	4.482	1.184	0.110	0.011
M22	0.485	0.063	1.067	0.145	0.150	0.017
M25	0.331	0.065	3.075	0.610	0.161	0.014
M28	0.618	0.065	1.963	0.218	0.100	0.013
M37	0.580	0.072	-0.409	0.066	0.149	0.027
M40	0.633	0.071	0.556	0.077	0.131	0.019
M43	0.599	0.074	2.789	0.358	0.095	0.011
D4	0.645	0.079	-0.710	0.101	0.135	0.035
D7	0.643	0.065	1.386	0.152	0.121	0.018
D16	0.691	0.070	0.544	0.075	0.125	0.022
D19	0.699	0.078	0.080	0.053	0.126	0.029
D22	0.724	0.084	-1.027	0.131	0.135	0.040
D25	0.535	0.072	-0.185	0.053	0.152	0.029
D28	0.516	0.063	1.916	0.246	0.163	0.016
D31	0.646	0.064	1.004	0.114	0.140	[illegible]19
D34	0.879	0.082	0.876	0.101	0.096	[illegible]20
D37	0.536	0.058	1.827	0.207	0.1[illegible]6	0.016
D40	0.427	0.057	-0.760	0.111	0.145	0.034
D43	0.534	0.066	0.689	0.099	0.151	0.02[illegible]

Knowledge of Facts and Concepts Subtest (38 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E2	0.435	0.073	-0.174	0.059	0.189	0.029
E5	0.430	0.064	-1.083	0.169	0.175	0.037
E8	0.558	0.080	-0.689	0.113	0.176	0.034
E11M	0.537	0.053	-0.733	0.079	0.171	0.023
E14	0.419	0.088	1.347	0.293	0.201	0.021
E17	0.704	0.076	-1.254	0.149	0.167	0.042
E20	0.596	0.111	0.677	0.142	0.174	0.022
E23	0.512	0.074	-0.892	0.139	0.176	0.036
E26	0.522	0.103	0.805	0.172	0.183	0.022
E29M	0.653	0.056	0.430	0.055	0.146	0.016
E32M	0.499	0.055	0.468	0.061	0.164	0.016
E35	0.538	0.110	1.602	0.339	0.178	0.018
E38	0.775	0.149	0.403	0.104	0.190	0.022
E41	0.510	0.089	-0.084	0.057	0.185	0.028
E44	0.464	0.077	-0.146	0.058	0.181	0.029
M2D	0.644	0.055	0.311	0.046	0.209	0.016
M5	0.688	0.085	-0.702	0.098	0.171	0.030
M8	0.446	0.067	1.217	0.192	0.193	0.017
M14D	0.851	0.053	1.831	0.130	0.143	0.009
M17	0.430	0.062	0.079	0.041	0.176	0.0[illegible]3
M20D	0.502	0.046	1.480	0.142	0.155	0.013
M23	0.516	0.082	0.754	0.112	0.188	0.018
M26	0.565	0.073	1.515	0.205	0.156	0.015
M35D	0.439	0.047	2.181	0.240	0.195	0.011
M38	0.822	0.090	1.073	0.132	0.166	0.015
M41	0.450	0.065	-0.848	0.130	0.179	0.030
M44	0.491	0.066	0.753	0.111	0.165	0.019
D5	0.553	0.057	1.426	0.158	0.166	0.018
D8	0.903	0.066	1.577	0.138	0.111	0.015
D11	0.960	0.151	-0.323	0.078	0.155	0.033
D17	0.507	0.055	2.252	0.256	0.173	0.016
D23	0.659	0.058	1.639	0.153	0.133	0.017
D26	0.783	0.064	2.104	0.195	0.115	0.015
D29	0.806	0.084	0.370	0.067	0.137	0.026
D32	0.506	0.057	-0.004	0.047	0.175	0.028
D38	0.684	0.089	-0.000	0.052	0.165	0.029
D41	0.493	0.074	3.940	[illegible]	0.082	0.011
D44	0.353	0.063	-1.936	0.351	0.188	0.045

Higher Level Thinking Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E3M	0.749	0.058	-0.756	0.068	0.147	0.024
E6	0.402	0.071	0.164	0.059	0.177	0.027
E9M	0.502	0.054	1.097	0.124	0.144	0.013
E12M	0.609	0.060	0.100	0.034	0.154	0.017
E15	0.948	0.096	-0.935	0.116	0.151	0.039
E18	0.366	0.062	-0.547	0.105	0.183	0.033
E21	0.484	0.078	0.063	0.054	0.179	0.027
E24	0.761	0.130	0.514	0.109	0.149	0.022
E27	0.323	0.063	0.036	0.055	0.197	0.029
E30	0.430	0.076	0.068	0.055	0.195	0.028
E33	0.528	0.149	3.121	0.898	0.132	0.014
E36	0.515	0.095	0.782	0.156	0.181	0.022
E39	0.473	0.152	3.455	1.125	0.135	0.014
E42M	0.416	0.053	1.625	0.213	0.167	0.013
E45	0.667	0.099	0.216	0.067	0.137	0.026
M60	0.771	0.049	1.140	0.084	0.147	0.011
M15	0.693	0.087	-0.299	0.058	0.163	0.026
M180	0.871	0.062	0.902	0.078	0.198	0.012
M210	0.482	0.043	2.301	0.211	0.124	0.010
M24	0.557	0.072	0.874	0.123	0.176	0.017
M27	0.477	0.062	-0.388	0.064	0.173	0.026
M30	0.604	0.115	3.746	0.737	0.082	0.009
M33	0.427	0.068	1.718	0.282	0.213	0.015
M360	0.644	0.054	0.344	0.044	0.165	0.016
M39	0.498	0.080	2.439	0.400	0.168	0.013
M45	0.801	0.094	-0.370	0.063	0.155	0.026
D3	1.102	0.163	-0.182	0.067	0.149	0.030
O9	0.851	0.064	0.891	0.090	0.137	0.019
O12	0.672	0.083	-0.112	0.052	0.165	0.029
O15	0.552	0.068	0.234	0.057	0.179	0.026
O24	0.646	0.062	2.307	0.238	0.137	0.014
O27	0.879	0.072	1.210	0.121	0.159	0.017
O30	0.945	0.076	1.502	0.149	0.167	0.016
O33	0.805	0.082	0.601	0.083	0.155	0.022
O39	0.493	0.056	1.798	0.214	0.170	0.018
O42	0.796	0.067	1.878	0.182	0.182	0.015
O45	0.540	0.058	1.317	0.153	0.164	0.019

* $p < .05$
** $p < .01$

FORM 3

ITEM PARAMETER ESTIMATES
EIGHT SUBTESTS

Numbers Subtest (29 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.725	0.078	-0.361	0.068	0.133	0.030
E2	0.440	0.061	-0.458	0.081	0.17[illegible]	0.031
E3M	0.554	0.045	-0.680	0.064	0.162	0.022
E4	0.855	0.105	0.267	0.070	0.122	0.022
E5	0.903	0.077	-0.899	0.099	0.144	0.036
E6	0.947	0.144	0.367	0.092	0.170	0.021
E7	1.283	0.138	1.134	0.164	0.090	0.014
E8	0.549	0.075	-0.020	0.054	0.161	0.027
E9	0.526	0.060	-1.054	0.132	0.167	0.037
E10	1.031	0.106	-0.637	0.094	0.155	0.032
E11M	0.647	0.044	-1.171	0.087	0.1[illegible]	0.027
E12M	0.662	0.053	-0.362	0.044	0.[illegible]9	0.019
M1	0.824	0.074	-0.586	0.068	0.144	0.027
M2D	0.665	0.048	0.286	0.03[illegible]	0.169	0.016
M4D	1.464	0.094	0.155	0.045	0.123	0.014
M5D	1.297	0.078	0.401	0.045	0.122	0.013
M6	0.974	0.111	0.278	0.065	0.221	0.017
M7	1.367	0.139	0.441	0.076	0.128	0.014
M8	0.344	0.052	-2.357	0.364	0.175	0.039
M9	1.036	0.090	0.811	0.091	0.097	0.013
M10D	0.607	0.044	-0.305	0.038	0.140	0.020
D1	1.326	0.078	0.840	0.082	0.122	0.018
D3	0.887	0.092	-0.247	0.060	0.154	0.034
D6	0.571	0.055	0.746	0.088	0.184	0.024
D7	1.501	0.102	0.632	0.079	0.100	0.021
D8	0.989	0.080	0.453	0.068	0.186	0.023
D9	0.927	0.067	0.877	0.087	0.172	0.020
D11	0.6[illegible]7	0.066	-0.513	0.074	0.158	0.037
D12	0.863	0.115	-0.870	0.131	0.154	0.046

Algebra Subtest (24 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E38	0.465	0.090	1.297	0.259	0.104	0.022
E39	0.472	0.088	-0.692	0.139	0.112	0.037
E40	0.550	0.100	-0.515	0.108	0.109	0.035
E41	0.624	0.114	-0.311	0.079	0.106	0.032
E42	0.499	0.090	1.536	0.287	0.095	0.020
E43M	0.581	0.067	0.617	0.079	0.036	0.015
E44	0.333	0.072	1.348	0.297	0.125	0.024
E45	0.531	0.097	0.091	0.056	0.109	0.029
M37	0.469	0.078	0.430	0.082	0.110	0.022
M38	0.392	0.072	0.586	0.116	0.119	0.021
M39	0.362	0.100	4.420	1.231	0.073	0.011
M40	0.463	0.077	0.935	0.162	0.113	0.019
M41	0.433	0.072	1.314	0.223	0.108	0.017
M42D	0.474	0.055	0.707	0.089	0.117	0.015
M44	0.283	0.097	5.258	1.317	0.082	0.011
M45	0.374	0.065	0.690	0.127	0.115	0.021
D37	0.495	0.072	1.963	0.293	0.101	0.017
D38	0.482	0.076	0.168	0.053	0.110	0.026
D39	0.547	0.096	-0.812	0.151	0.113	0.036
D40	0.628	0.078	1.373	0.183	0.110	0.018
D41	0.487	0.075	-0.233	0.058	0.112	0.030
D43	0.324	0.076	3.743	0.770	0.109	0.016
D44	0.446	0.070	2.[illegible]66	0.377	0.091	0.017
D45	0.774	0.104	0.672	0.107	0.091	0.022

Geometry Subtest (21 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E13M	0.889	0.076	0.647	0.067	0.070	0.013
E14	0.643	0.126	0.822	0.172	0.076	0.020
E15M	0.526	0.056	-0.131	0.033	0.089	0.020
E16	0.267	0.060	0.278	0.078	0.107	0.028
E17	0.274	0.063	0.085	0.051	0.107	0.029
E18M	0.459	0.047	0.397	0.051	0.086	0.016
E19	0.398	0.133	3.438	1.155	0.063	0.016
E20M	0.457	0.050	0.849	0.098	0.095	0.014
E21	0.418	0.087	0.719	0.159	0.093	0.024
M14	0.685	0.066	1.049	0.111	0.073	0.015
M16	0.531	0.057	1.344	0.152	0.074	0.016
M17D	0.282	0.038	-1.074	0.149	0.103	0.023
M19	0.608	0.062	1.391	0.150	0.078	0.015
M21	0.591	0.061	1.123	0.125	0.075	0.016
D13	0.589	0.107	-0.347	0.079	0.088	0.030
D14	0.402	0.076	2.587	0.497	0.093	0.015
D16	0.533	0.081	-1.685	0.263	0.091	0.044
D18	0.580	0.081	1.595	0.231	0.069	0.017
D19	0.457	0.076	2.143	0.363	0.086	0.016
D20	0.457	0.086	-0.126	0.052	0.096	0.029
D21	0.501	0.089	0.130	0.050	0.091	0.026

Measurement Subtest (21 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E22	0.552	0.092	0.241	0.070	0.145	0.026
E23	0.731	0.133	0.333	0.089	0.134	0.024
E24	0.534	0.082	-0.432	0.086	0.160	0.031
E25M	0.524	0.061	0.051	0.033	0.152	0.018
E26M	0.680	0.076	0.635	0.081	0.131	0.014
E27	0.534	0.094	0.523	0.110	0.144	0.024
E28	0.649	0.114	0.162	0.069	0.159	0.026
E29M	0.563	0.068	0.214	0.043	0.154	0.018
E30	0.558	0.111	0.836	0.180	0.159	0.0[illegible]2
M22	0.396	0.082	2.532	0.528	0.158	0.015
M23	0.338	0.067	1.228	0.249	0.188	0.019
M24D	0.556	0.053	1.971	0.195	0.143	0.011
M27	0.416	0.072	0.800	0.145	0.168	0.020
M28D	0.548	0.052	1.793	0.176	0.141	0.011
M30D	0.490	0.060	2.559	0.[illegible]22	0.175	0.010
D22	0.483	0.064	1.812	0.[illegible]48	0.141	0.018
D23	0.349	0.059	-0.125	0.050	0.172	0.029
D25	0.522	0.070	0.823	0.123	0.155	0.022
D26	0.584	0.081	0.920	0.140	0.164	0.021
D27	0.926	0.086	1.086	0.124	0.105	0.019
D29	0.466	0.068	1.885	0.285	0.149	0.019

Probability and Statistics Subtest (15 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E31	0.927	0.061	1.848	0.182	0.155	0.006
E32	0.662	0.059	-0.515	0.030	0.178	0.016
E33	0.671	0.043	-0.06	0.044	0.135	0.013
E34	1.369	0.056	0.708	0.075	0.074	0.007
E35	0.893	0.101	-0.598	0.032	0.150	0.016
E36	0.718	0.069	-0.639	0.029	0.152	0.016
M31	0.451	0.096	3.416	0.757	0.060	0.008
M32	0.428	0.057	-1.172	0.145	0.110	0.025
M33	0.436	0.073	0.327	0.082	0.114	0.017
M340	0.387	0.047	1.035	0.114	0.116	0.013
M350	0.530	0.059	-0.321	0.057	0.118	0.018
M360	0.455	0.052	0.451	0.044	0.111	0.015
O31	0.516	0.070	0.936	0.086	0.109	0.023
O32	0.576	0.089	-0.250	0.109	0.117	0.034
O33	0.742	0.107	0.538	0.052	0.097	0.026

Procedural Skills Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.870	0.112	-0.375	0.076	0.105	0.030
E4	0.568	0.091	0.501	0.098	0.121	0.023
E7	0.999	0.131	1.271	0.193	0.081	0.014
E10	0.641	0.082	-0.765	0.112	0.120	0.035
E13M	0.690	0.059	0.711	0.071	0.106	0.012
E16	0.387	0.062	0.155	0.055	0.133	0.027
E 9	0.544	0.156	3.072	0.899	0.089	0.015
E22	0.598	0.091	0.205	0.063	0.121	0.025
E25M	0.43[illegible]	0.040	-0.162	0.033	0.119	0.019
E28	0.[illegible]98	0.082	0.280	0.072	0.139	0.025
E31	0.532	0.121	2.642	0.615	0.125	0.014
E34	0.838	0.126	1.576	0.259	0.098	0.014
E40	0.516	0.067	-0.700	0.104	0.126	0.034
E43M	0.600	0.055	0.498	0.057	0.111	0.015
M1	0.994	0.097	-0.535	0.066	0.106	0.026
M40	0.912	0.058	0.166	0.036	0.098	0.016
M7	0.975	0.093	0.605	0.077	0.111	0.015
M100	0.626	0.047	-0.329	0.039	0.112	0.021
M16	0.535	0.064	1.380	0.173	0.120	0.015
M19	0.852	0.086	1.102	0.127	0.114	0.014
M22	0.525	0.088	2.247	0.387	0.192	0.013
M280	0.931	0.046	1.016	0.063	0.073	0.011
M31	0.949	0.083	1.980	0.197	0.066	0.009
M340	0.518	0.042	0.950	0.085	0.159	0.014
M37	0.522	0.059	0.293	0.052	0.116	0.021
M40	0.747	0.079	0.538	0.074	0.114	0.017
O1	1.479	0.089	0.753	0.084	0.091	0.017
O7	1.247	0.087	0.605	0.075	0.084	0.022
O13	0.724	0.074	0.177	0.054	0.133	0.027
O16	0.511	0.062	-1.318	0.170	0.122	0.044
O19	0.639	0.056	2.338	0.221	0.125	0.014
O22	0.478	0.050	2.000	0.216	0.127	0.017
O25	0.491	0.048	1.033	0.113	0.135	0.022
O31	0.419	0.045	0.864	0.104	0.125	0.024
O37	0.553	0.054	2.316	0.236	0.117	0.015
O40	0.713	0.049	1.535	0.122	0.100	0.017
O43	0.371	0.071	3.719	0.722	0.143	0.015

Knowledge of Facts and Concepts Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E2	0.266	0.053	-0.552	0.121	0.167	0.032
E5	0.631	0.067	-1.098	0.130	0.135	0.038
E8	0.374	0.060	-0.041	0.051	0.145	0.028
E11M	0.658	0.047	-1.190	0.093	0.136	0.027
E14	0.834	0.137	0.523	0.109	0.093	0.020
E17	0.242	0.051	0.324	0.085	0.169	0.028
E20M	0.575	0.063	0.672	0.082	0.140	0.014
E23	0.381	0.071	0.768	0.153	0.135	0.024
E26M	0.394	0.051	0.893	0.120	0.141	0.014
E29M	0.763	0.072	-0.038	0.036	0.138	0.017
E32	0.397	0.065	-0.120	0.055	0.148	0.029
E35	0.731	0.090	-0.472	0.082	0.125	0.031
E38	0.376	0.083	1.690	0.381	0.160	0.020
E41	0.465	0.068	-0.538	0.095	0.148	0.032
E44	0.479	0.081	0.701	0.134	0.136	0.023
M20	0.590	0.050	0.254	0.038	0.138	0.017
M50	1.139	0.079	0.448	0.051	0.110	0.014
M8	0.324	0.056	-2.444	0.429	0.157	0.040
M14	0.750	0.086	0.824	0.106	0.099	0.015
M170	0.342	0.039	-0.689	0.085	0.150	0.022
M23	0.303	0.055	0.851	0.161	0.154	0.020
M32	0.597	0.070	-0.815	0.104	0.140	0.030
M350	0.453	0.046	-0.314	0.043	0.154	0.021
M38	0.346	0.059	0.653	0.119	0.147	0.021
M41	0.383	0.068	1.575	0.285	0.148	0.016
M44	0.332	0.111	4.717	1.595	0.095	0.011
O8	0.467	0.055	0.294	0.057	0.139	0.028
O11	0.572	0.086	-0.579	0.101	0.139	0.038
O14	0.462	0.059	2.881	0.375	0.110	0.015
O20	0.500	0.058	0.423	0.069	0.137	0.028
O23	0.402	0.051	0.096	0.046	0.143	0.030
O26	0.357	0.049	1.460	0.208	0.147	0.022
O29	0.398	0.055	2.282	0.322	0.135	0.019
O32	0.471	0.063	-0.458	0.077	0.140	0.036
O38	0.741	0.069	0.556	0.073	0.121	0.025
O41	0.375	0.051	0.219	0.054	0.148	0.029
O44	0.380	0.057	3.136	0.480	0.100	0.016

Higher Level Thinking Subtest (36 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E3M	0.597	0.053	-0.579	0.061	0.125	0.023
E6	0.471	0.077	0.638	0.118	0.131	0.024
E9	0.524	0.071	-1.018	0.149	0.139	0.038
E12M	0.534	0.052	-0.273	0.041	0.136	0.020
E15M	0.477	0.048	-0.051	0.031	0.133	0.019
E18M	0.462	0.048	0.477	0.059	0.122	0.016
E21	0.751	0.102	0.426	0.084	0.112	0.023
E24	0.382	0.061	-0.386	0.079	0.141	0.032
E27	0.617	0.094	0.515	0.098	0.126	0.023
E30	0.597	0.096	0.804	0.145	0.134	0.022
E33	0.580	0.089	0.273	0.071	0.140	0.025
E36	0.741	0.104	-0.353	0.076	0.130	0.031
E39	0.415	0.063	-0.779	0.130	0.149	0.036
E42	0.680	0.093	1.076	0.164	0.101	0.020
E45	0.442	0.071	0.091	0.054	0.141	0.028
M6	0.765	0.106	0.398	0.074	0.171	0.019
M9	0.763	0.070	1.224	0.124	0.091	0.014
M21	0.749	0.073	0.976	0.107	0.102	0.016
M240	0.588	0.052	2.019	0.186	0.162	0.010
M27	0.371	0.056	0 724	0.117	0.155	0.020
M30D	0.511	0.052	2.135	0.223	0.145	0.011
M33	0.381	0.057	0.803	0.127	0.150	0.019
M360	0.361	0.039	0.517	0.064	0.147	0.017
M39	0.398	0.116	4.532	1.330	0.092	0.010
M420	0.467	0.042	0.795	0.079	0.128	0.015
M45	0.357	0.059	0.997	0.170	0.162	0.020
O3	0.884	0.111	-0.608	0.096	0.137	0.035
O6	0.603	0.076	0.365	0.069	0.159	0.024
O9	0.506	0.057	0.648	0.088	0.138	0.023
O12	0.552	0.077	-1.665	0.239	0.140	0.047
O18	0.4[illegible]	0.062	2.368	0.309	0.122	0.015
O21	0.790	0.094	0.409	0.075	0.162	0.022
O27	0.925	0.079	1.011	0.108	0.085	0.019
O33	0.464	0.054	0.167	0.050	0.14[illegible]	0.027
O39	0.631	0.076	-0.635	[illegible] 09[illegible]	0.133	0.036
O45	0.821	0.079	0.799	[illegible].097	0.113	0.020

* $p < .05$
** $p < .01$

FORM 4

ITEM PARAMETER ESTIMATES
EIGHT SUBTESTS

Numbers Subtest (31 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.791	0.124	0.866	0.155	0.174	0.020
E2	0.519	0.086	[illegible]	0.096	0.185	0.025
E3	0.709	0.104	-0.323	0.074	0.178	[illegible]
E4	0.631	0.099	-0.628	0.113	0.184	[illegible]
E5M	0.446	0.047	0.185	0.038	0.184	0.017
E6	0.714	0.112	1.051	0.181	0.183	0.019
E7M	0.499	0.058	1.651	0.199	0.199	0.012
E8	0.548	[illegible]	3.084	0.656	0.114	0.013
E9	0.472	[illegible]	-0.228	0.065	0.200	0.030
E10	0.658	0.095	-0.921	0.145	0.184	0.039
E11	0.583	0.092	-0.058	0.054	0.177	0.029
E12	0.708	0.082	-1.095	0.141	0.175	0.042
M1	0.398	[illegible]	0.255	0.054	0.199	0.021
M2	0.752	0.082	-0.516	0.072	0.169	0.027
M30	0.559	0.050	0.652	0.068	0.170	0.014
M40	0.460	0.046	-0.116	0.033	0.178	0.019
M6	0.707	0.086	0.165	0.050	0.178	0.020
M8	0.439	0.071	1.865	0.307	0.191	0.016
M9	0.836	0.101	-0.246	0.056	0.174	0.024
M10	0.500	0.068	1.396	0.199	0.169	0.015
M110	0.619	0.059	0.317	0.047	0.204	0.016
M12	[illegible]	0.067	-0.166	0.045	0.157	0.024
O1	1.312	0.136	0.512	0.085	0.115	0.020
O2	0.647	0.078	0.223	0.057	0.171	0.025
D5	0.731	0.096	-0.652	0.093	0.164	0.036
O6	0.862	0.087	1.044	0.126	0.197	[illegible]
O7	[illegible]	0.103	0.052	0.055	0.171	0.027
O8	0.512	0.061	1.412	0.179	0.174	0.019
O9	0.635	0.074	0.623	0.091	0.206	0.022
O11	0.956	0.119	-0.729	0.109	0.172	0.038
O12	0.330	0.051	-1.245	0.200	0.198	0.037

Algebra Subtest (22 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E37	0.787	0.128	-0.272	0.073	0.176	0.031
E38	0.997	0.183	0.141	0.073	0.159	0.026
E39M	0.771	0.074	0.930	0.102	0.212	0.013
E40M	0.511	0.059	0.667	0.086	0.222	0.015
E41	0.668	0.140	2.019	0.444	0.234	0.017
E42	0.794	0.113	0.296	0.074	0.160	0.024
E43	0.783	0.130	0.299	0.079	0.164	0.024
E44	0.614	0.231	3.695	1.436	0.127	0.013
E45	0.593	0.095	0.256	0.071	0.180	0.027
M370	1.090	0.100	0.322	0.053	0.185	0.016
M380	1.120	0.060	1.198	0.086	0.174	0.011
M41	1.184	0.163	0.188	0.061	0.141	0.021
M42	0.843	0.103	-0.183	0.052	0.163	0.025
M43	0.700	0.079	0.679	0.092	0.175	0.018
M44	0.589	0.070	1.042	0.134	0.183	0.017
M450	0.528	0.055	2.709	0.294	0.181	0.010
O39	1.409	0.117	0.798	0.110	0.134	[illegible]
O40	0.899	0.062	1.923	0.160	0.124	0.015
O41	1.033	0.077	0.833	0.094	0.150	0.021
O42	0.592	0.128	4.259	0.956	0.121	0.012
O43	0.939	0.066	1.918	0.167	0.140	0.015
O44	0.714	0.077	2.735	0.324	0.149	0.014

Geometry Subtest (22 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E13	0.344	0.093	0.538	0.154	0.120	0.025
E14	0.341	0.099	1.360	0.401	0.117	0.022
E15	0.300	0.076	-0.668	0.177	0.125	0.033
E16	0.398	0.108	0.476	0.139	0.115	0.025
E17	0.270	0.073	0.375	0.112	0.128	0.027
E18	0.333	0.105	2.146	0.681	0.109	0.020
E19	0.467	0.131	1.714	0.488	0.090	0.018
E20M	0.373	0.057	1.365	0.214	0.109	0.013
E21M	0.428	0.063	0.536	0.085	0.111	0.016
M13	0.628	0.074	1.581	0.195	0.079	0.013
M140	0.242	0.039	1.466	0.241	0.119	0.015
M150	0.479	0.056	-0.383	0.053	0.114	0.021
M16	0.314	0.070	-3.570	0.801	0.126	0.049
M17	0.578	0.088	-0.147	0.046	0.103	0.024
M180	0.227	0.041	2.902	0.536	0.117	0.012
M19	0.512	0.074	1.104	0.166	0.093	0.017
D13	0.477	0.064	2.325	0.319	0.079	0.015
O16	0.456	0.099	-2.286	0.503	0.116	0.052
O17	0.455	0.065	1.192	0.179	0.102	0.020
O19	0.805	0.111	0.621	0.103	0.097	0.023
O20	0.422	0.063	1.415	0.219	0.103	0.021
O21	0.819	0.078	1.355	0.148	0.082	0.019

Measurement Subtest (23 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E22	0.583	0.098	2.237	0.391	0.133	0.015
E23	0.517	0.091	-0.025	.053	0.179	0.029
E24	0.481	0.113	3.110	0.744	0.139	0.014
E25	0.742	0.134	0.343	0.088	0.172	0.024
E26M	0.569	0.057	0.950	0.103	0.173	0.014
E27	0.729	0.127	-0.201	0.069	0.161	0.031
E28M	0.660	0.067	0.515	[illegible]	0.192	0.015
E29	0.593	0.092	-0.206	0.063	0.166	0.031
E30	0.746	0.097	2.073	0.289	0.093	0.015
M22	0.444	0.058	1.184	0.163	0.175	0.017
M23	0.404	0.056	-0.040	0.040	0.196	0.023
M24	0.487	0.062	0.747	0.105	0.167	0.019
M25	0.855	0.100	0.241	[illegible]	[illegible]	0.020
M27	0.925	0.112	-0.364	0.066	0.153	0.027
M290	0.806	0.064	0.691	0.068	0.161	0.013
M30	0.972	0.114	0.502	0.081	0.154	0.018
O22	0.350	0.060	0.259	0.064	0.194	0.026
O23	0.452	0.069	0.986	0.160	0.178	0.022
O24	0.575	0.095	-0.011	0.050	0.175	0.028
O25	0.592	0.077	0.813	0.118	0.161	0.021
O27	0.595	0.081	1.664	0.239	0.170	0.018
D28	0.700	0.077	1.427	0.171	0.132	0.018
O30	0.714	0.112	0.204	0.063	0.172	0.026

Probability and Statistics Subtest (14 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E31M	[illegible]	0.072	3.487	0.596	0.075	0.008
E32	0.455	0.075	-0.566	0.106	0.125	0.032
E33	0.816	0.105	-0.703	0.108	0.110	0.034
E34M	0.668	0.077	519	0.070	0.107	0.015
E35	0.648	0.068	2.089	0.232	0.122	0.052
E36M	0.639	0.073	0.561	0.073	0.101	0.015
M320	0.371	0.052	-0.128	0.033	0.132	0.019
M33	0.377	0.062	1.460	0.245	0.130	0.018
M35	0.384	0.063	1.672	0.278	0.130	0.017
D31	0.656	0.124	0.449	[illegible]	0.111	0.024
D33	0.504	0.088	1.076	0.194	0.117	0.020
D34	0.265	0.076	3.672	1.061	0.127	0.016
D35	0.394	0.081	1.697	0.353	0.125	0.019
D36	0.587	0.115	-0.596	0.127	0.121	0.033

Procedural Skills Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.694	0.118	0.532	0.109	0.124	0.021
E4	0.537	0.075	-0.970	0.146	0.142	0.036
E7M	0.557	0.050	1.111	0.108	[illegible]	0.013
E10	0.630	0.075	-1.219	0.156	0.135	0.040
E13	0.470	0.078	0.406	0.085	0.146	0.024
E16	0.546	0.096	0.348	0.082	0.141	0.024
E19	0.370	0.096	2.759	0.727	0.150	0.016
E22	0.727	0.120	1.422	0.249	0.097	0.015
E25	0.434	0.072	0.258	0.066	0.145	0.025
E28M	0.661	0.065	0.295	0.044	0.134	0.016
E31M	0.480	0.068	3.437	0.494	0.092	0.007
E34M	0.554	0.050	0.590	0.062	0.119	[illegible]
E37	0.575	0.083	-0.533	0.092	[illegible]	0.032
E40M	0.542	0.061	0.510	0.068	0.188	0.015
E43	0.492	0.084	0.237	0.065	0.132	0.026
M1	0.296	0.045	0.262	0.054	0.154	0.023
M40	0.426	0.044	-0.109	0.032	0.159	0.019
M10	0.314	0.053	2.094	0.358	[illegible]	0.016
M13	0.663	0.066	1.862	0.197	0.120	0.012
M16	0.323	0.066	-3.338	0.691	0.154	0.049
M19	0.715	0.068	0.980	0.106	0.107	0.017
M22	0.472	0.058	1.026	0.134	0.141	0.017
M25	0.589	0.067	0.365	0.059	0.136	0.021
M370	0.697	0.059	0.282	0.042	0.138	0.017
M43	0.785	0.088	0.572	0.080	0.130	0.019
D1	1.381	0.145	0.411	0.080	0.079	0.020
D7	0.541	0.064	-0.105	0.048	0.137	0.028
D13	0.696	0.062	1.950	0.190	0.098	0.014
D16	0.770	0.086	-1.589	0.192	0.136	0.052
D19	0.853	0.085	0.675	0.090	0.130	0.021
D22	0.450	0.058	0.037	0.045	0.141	0.027
D25	0.537	0.060	0.796	[illegible]	0.137	0.021
D28	0.459	0.057	1.967	0.254	0.133	0.017
O31	0.557	0.060	0.671	0.088	0.132	0.022
O34	0.335	0.069	3.682	0.773	0.162	0.015
O40	0.626	0.067	2.222	0.255	0.121	0.015
D43	0.702	0.069	1.889	0.203	0.111	0.015

Knowledge of Facts and Concepts Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E2	0.536	0.099	0.320	0.079	0.149	0.026
E5M	0.564	0.060	0.011	0.032	0.151	0.018
E8	0.402	0.120	3.800	1.147	0.105	0.013
E11	0.314	0.063	-0.024	0.048	0.171	0.029
E14	0.369	0.083	1.768	0.403	0.169	0.020
E17	0.403	0.080	0.540	0.120	0.175	0.025
E20M	0.302	0.051	2.201	0.379	0.174	0.012
E23	0.427	0.077	-0.066	0.051	0.161	0.029
E26M	0.508	0.059	0.828	0.102	0.114	0.014
E29	0.660	[illegible]	-0.252	0.071	0.140	0.031
E32	0.406	0.070	-0.280	0.068	0.154	0.031
E35	0.893	0.087	-1.557	0.171	0.145	0.052
E38	0.481	0.094	0.453	0.104	0.164	0.026
[illegible]	[illegible]	0.094	2.169	0.510	0.170	0.019
[illegible]	0.399	[illegible]	4.064	1.342	0.099	0.014
M2	0.746	[illegible]	-0.595	0.078	0.145	0.027
M8	0.463	[illegible]	1.597	0.261	0.170	0.016
M110	0.465	0.044	0.156	0.034	0.147	0.018
M140	0.320	0.040	1.419	0.183	0.165	0.014
M17	0.555	0.072	-0.113	0.043	0.154	0.023
M23	0.384	0.056	-0.247	0.052	0.170	0.024
M290	0.693	0.058	0.668	0.066	0.139	0.014
M320	0.293	0.036	0.014	0.029	0.185	0.018
M35	0.312	0.060	1.964	0.383	0.163	0.016
M380	[illegible]	0.052	1.200	0.094	0.135	0.011
M41	[illegible]	0.071	0.214	0.050	0.137	0.021
M44	0.522	0.074	0.880	0.134	0.152	0.018
O2	0.756	0.087	0.200	0.057	0.139	0.026
O5	0.621	0.082	-0.701	0.106	0.151	0.036
D8	0.397	0.052	1.679	0.228	0.159	0.019
D11	0.687	0.080	-0.913	0.120	0.145	0.040
O17	0.447	0.055	1.548	0.201	0.152	0.019
D20	0.764	0.071	1.234	0.132	0.140	0.019
D23	0.348	0.053	1.397	0.219	0.187	0.021
D35	0.584	0.063	[illegible]	0.188	0.152	0.018
D41	0.898	0.081	0.762	0.092	0.112	0.022
O44	0.426	0.066	3.192	0.505	0.114	0.015

Higher Level Thinking Subtest (38 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E3	0.531	0.071	-0.776	0.116	0.159	0.033
E6	0.643	0.114	0.467	0.102	0.135	0.022
E9	0.609	0.076	-0.677	0.100	0.160	0.031
E12	0.480	0.059	-1.756	0.224	0.159	0.043
E15	0.537	0.074	-0.646	0.102	0.165	0.031
E18	0.479	0.140	2.023	0.602	0.184	0.017
E21M	0.722	0.070	0.581	0.070	0.194	0.014
E24	0.496	0.169	2.768	0.953	0.145	0.014
E27	0.585	0.079	-0.561	0.093	0.157	0.031
E30	0.656	0.176	1.850	0.508	0.094	0.015
E33	0.643	0.075	-0.790	0.106	0.157	0.033
E36M	1.016	0.081	0.407	0.053	0.137	0.013
E39M	0.538	0.056	0.875	0.099	0.160	0.014
E42	0.586	0.096	0.066	0.055	0.151	0.025
E45	0.456	0.080	0.014	0.054	0.171	0.027
M30	0.474	0.041	0.834	0.079	0.161	0.015
M6	0.664	0.065	0.186	0.045	0.131	0.022
M9	0.653	0.073	-0.129	0.045	0.164	0.024
M12	0.691	0.070	-0.021	0.042	0.146	0.023
M150	0.579	0.050	-0.127	0.033	0.158	0.019
M180	0.404	0.042	2.233	0.237	0.155	0.011
M24	0.606	0.057	0.573	0.069	0.128	0.020
M27	0.931	0.093	-0.262	0.055	0.148	0.025
M30	0.748	0.069	0.584	0.070	0.125	0.019
M33	0.565	0.061	1.166	0.135	0.160	0.016
M42	0.319	0.044	-0.112	0.041	0.182	0.025
M450	0.338	0.051	3.539	0.541	0.167	0.010
O6	0.638	0.059	1.012	0.108	0.134	0.020
O9	0.716	0.076	0.440	0.069	0.135	0.025
O12	0.239	0.042	-1.569	0.283	0.189	0.037
O21	0.653	0.061	2.025	0.208	0.144	0.017
O24	0.802	0.089	0.122	0.053	0.166	0.028
O27	0.790	0.068	1.326	0.134	0.127	0.019
O30	0.591	0.077	0.341	0.066	0.162	0.026
O33	0.753	0.071	1.341	0.144	0.179	0.017
O36	0.555	0.076	-0.300	0.063	0.161	0.032
O39	0.927	0.086	1.003	0.116	0.145	0.020
O42	0.422	0.082	4.418	0.876	0.097	0.012

* $p < .05$
** $p < .01$

FORM 5

ITEM PARAMETER ESTIMATES
EIGHT SUBTESTS

Numbers Subtest (29 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.404	0.063	-0.273	0.064	0.139	0.030
E2M	0.565	0.053	-0.068	0.032	0.131	0.018
E3	0.566	0.079	-0.660	0.105	0.130	0.033
E4	0.376	0.062	-1.873	0.312	0.139	0.043
E5	0.785	0.072	-1.855	0.185	0.127	0.052
E6	0.468	0.070	-0.368	0.073	0.134	0.030
E7M	0.884	0.080	0.037	0.036	0.107	0.016
E8	0.496	0.081	0.193	0.060	0.139	0.025
E9	0.648	0.102	0.110	0.057	0.143	0.025
E10	0.418	0.062	1.679	0.255	0.136	0.042
E11	0.619	0.077	-0.654	0.096	0.123	0.033
E12	0.643	0.092	-0.215	0.059	0.120	0.028
M10	0.607	0.052	0.060	0.032	0.131	0.017
M3	0.321	0.046	-0.411	0.069	0.142	0.025
M4	0.667	0.079	0.381	0.063	0.123	0.019
M50	0.424	0.042	-1.244	0.127	0.137	0.026
M6	0.769	0.075	-0.427	0.061	0.135	0.025
M8	0.747	0.073	2.444	0.258	0.058	0.010
M90	0.534	0.046	-0.220	0.035	0.132	0.019
M10	0.506	0.057	-0.932	0.113	0.131	0.030
M11	0.669	0.059	-1.709	0.160	0.134	0.042
M120	0.508	0.044	-1.087	0.100	0.132	0.026
O2	0.578	0.066	0.186	0.051	0.120	0.027
O3	0.673	0.092	-0.123	0.051	0.135	0.029
O4	0.850	0.116	-0.165	0.057	0.119	0.030
O6	0.422	0.061	2.208	0.329	0.124	0.018
O7	0.763	0.087	0.311	0.062	0.124	0.024
O8	0.852	0.077	0.542	0.071	0.087	0.022
O11	0.821	-0.082	0.697	0.089	0.130	0.020

Algebra Subtest (23 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
[illegible]	0.354	0.068	-0.722	0.147	0.113	[illegible]
[illegible]M	0.282	0.045	1.343	0.217	0.121	[illegible]
E30	0.502	0.080	1.035	0.175	0.096	0.021
E31	0.625	0.103	0.413	0.086	0.097	0.024
E32	0.483	0.094	3.157	0.628	0.068	0.013
E33M	0.414	0.053	1.790	0.235	0.117	0.012
E34	0.792	0.142	-0.211	0.068	0.091	0.030
E35	0.790	0.101	1.111	0.157	0.076	0.018
E36	0.407	0.081	2.548	0.512	0.099	0.016
M28	0.484	0.074	0.150	0.046	0.103	0.023
M30	0.471	0.070	1.223	0.188	0.101	0.016
M310	0.545	0.057	0.721	0.082	0.094	0.014
M32	0.662	0.097	0.515	0.087	0.093	0.019
M34	0.448	0.086	3.152	0.613	0.075	0.012
M35	0.660	0.090	0.759	0.114	0.082	0.018
O28	0.622	0.113	-0.546	0.111	0.102	0.034
O23	0.380	0.066	1.244	0.221	0.115	0.021
O30	0.437	0.103	4.372	1.044	0.056	0.011
O32	0.451	0.075	1.231	0.212	0.106	0.021
O33	0.547	0.097	-0.782	0.147	0.104	0.035
O34	0.315	0.076	3.312	0.802	0.128	0.016
O35	0.507	0.083	2.495	0.418	0.079	0.018
O36	0.444	0.083	-1.386	0.264	0.108	0.040

Geometry Subtest (21 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E37	0.405	0.108	3.232	0.871	0.164	0.015
E38	0.423	0.086	0.616	0.136	0.159	0.026
E39M	0.404	0.087	3.216	0.695	0.146	0.010
E40	0.459	0.08	1.425	0.283	0.145	0.021
E41	0.472	0.089	0.101	0.054	0.146	0.030
E42	0.415	0.131	4.036	1.289	0.11[illegible]	0.014
E43M	0.555	0.070	2.015	0.260	0.108	0.010
E44	0.518	0.090	1.741	0.311	0.130	0.018
E45	0.565	0.136	-0.099	0.059	0.135	0.031
M370	0.379	0.055	2.571	0.379	0.165	0.011
M380	-0.614	0.070	0.738	0.092	0.164	0.014
M400	0.388	0.080	4.252	0.883	0.139	0.009
M41	0.493	0.095	-0.326	0.075	0.153	0.026
M42	0.548	0.113	2.904	0.609	0.107	0.011
M44	0.560	0.106	1.378	0.[illegible]58	0.143	0.016
M450	0.518	0.059	2.363	0.[illegible]6	0.137	0.010
O39	0.627	0.072	1.198	0.[illegible]0	0.148	0.018
O41	0.596	0.068	1.746	0.2[illegible]1	0.144	0.017
O42	0.607	0.067	1.945	0.2[illegible]	0.132	0.016
O43	0.865	0.107	0.472	0.083	0.133	0.023
O44	1.195	0.186	0.365	0.089	0.111	0.024

Measurement Subtest (23 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E13	0.580	0.086	1.726	0.266	0.118	0.017
E14	0.767	0.149	-0.179	0.067	0.122	0.031
E15	0.485	0.082	2.256	0.392	0.115	0.016
E16	0.413	0.077	2.361	0.448	0.124	0.017
E17M	0.287	0.047	-0.153	0.038	0.162	0.0[illegible]0
E18	0.572	0.095	0.073	0.054	0.125	0.029
E19	0.486	0.082	0.832	0.151	0.137	0.023
E20	0.665	0.116	-0.414	0.091	0.128	0.033
E21M	0.527	0.061	2.360	0.281	0.113	0.010
M13	0.427	0.085	-0.618	0.130	0.146	0.029
M140	0.386	0.057	2.333	0.349	0.170	0.011
M150	0.307	0.054	2.750	0.487	0.155	0.011
M16	0.380	0.078	0.220	0.060	0.154	0.023
M18	0.507	0.096	-0.034	0.041	0.140	0.024
M19	0.422	0.082	0.406	0.088	0.149	0.022
M20	0.332	0.068	0.957	0.200	0.158	0.020
O13	0.624	0.084	0.658	0.103	0.114	0.021
O16	0.455	0.070	-2.509	0.391	0.142	0.052
O17	0.635	0.090	0.892	0.138	0.119	0.020
O18	0.869	0.107	0.807	0.116	0.088	0.019
O19	0.452	0.077	2.106	0.365	0.124	0.016
O20	0.795	0.095	1.014	0.136	0.091	0.018
O21	0.660	0.103	-0.270	0.065	0.129	0.029

Probability and Statistics Subtest (14 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E22M	0.262	0.070	4.860	1.307	0.055	0.008
E23	0.548	0.111	0.314	0.082	0.077	0.025
E24	0.656	0.134	-0.261	0.075	0.078	0.029
E25M	0.412	0.067	1.543	0.253	0.080	0.012
E26	0.454	0.084	-0.866	0.168	0.085	0.034
E27M	0.356	0.063	-0.253	0.053	0.088	0.020
M23D	0.344	0.058	0.218	0.046	0.090	0.018
M24	0.258	0.068	1.119	0.300	0.093	0.020
M26	0.330	0.098	4.230	1.261	0.050	0.013
D22	0.564	0.083	-1.379	0.211	0.081	0.040
D24	0.792	0.139	0.326	0.077	0.061	0.023
D25	0.513	0.089	-0.191	0.055	0.081	0.028
D26	0.279	0.061	-2.733	0.604	0.094	0.043
D27	0.407	0.076	-1.799	0.339	0.087	0.041

Procedural Skills Subtest (36 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.259	0.054	-0.252	0.070	0.129	0.030
E4	0.268	0.059	-2.331	0.519	0.128	0.043
E7M	0.595	0.063	0.055	0.032	0.105	0.017
E10	0.405	0.074	-1.700	0.315	0.116	0.042
E13	0.410	0.082	1.928	0.392	0.097	0.017
E16	0.313	0.073	2.584	0.611	0.111	0.017
E19	0.281	0.062	1.077	0.243	0.121	0.024
E22M	0.258	0.064	5.346	1.333	0.071	0.008
E25M	0.408	0.052	1.657	0.216	0.102	0.012
E28	0.517	0.089	-0.715	0.133	0.111	0.034
E31	0.534	0.102	0.344	0.084	0.[illegible]6	0.025
E34	0.50[illegible]	0.089	-0.368	0.082	0.109	0.031
E37	0.504	0.085	1.729	0.300	0.088	0.017
E40	0.305	0.065	1.523	0.329	0.115	0.021
E43M	0.503	0.063	2.232	0.284	0.116	0.010
M1D	0.566	0.057	-0.033	0.030	0.103	0.018
M4	0.439	0.069	0.416	0.076	0.108	0.020
M10	0.664	0.073	-0.889	0.106	0.102	0.031
M13	0.395	0.059	-0.878	0.138	0.116	0.029
M16	0.307	0.053	-0.020	0.037	0.123	0.024
M19	0.270	0.050	0.341	0.073	0.127	0.022
M28	0.388	0.064	0.208	0.052	0.113	0.023
M31D	0.483	0.049	0.879	0.095	0.104	0.014
M34	0.360	0.082	3.879	0.897	0.084	0.011
M37D	0.250	0.041	2.758	0.467	0.107	0.012
M40D	0.285	0.054	4.021	0.763	0.080	0.009
D4	0.428	0.072	-0.306	0.068	0.119	0.031
D7	0.574	0.076	0.297	0.060	0.096	0.026
D13	0.577	0.067	0.863	0.112	0.085	0.022
D16	0.485	0.077	-2.172	0.353	0.113	0.050
D19	0.366	0.061	2.500	0.421	0.097	0.017
D22	0.450	0.074	-1.355	0.228	0.112	0.041
D25	0.408	0.063	0.086	0.045	0.114	0.028
D28	0.518	0.079	-0.486	0.087	0.106	0.033
D34	0.229	0.057	3.727	0.940	0.100	0.018
D43	0.466	0.067	0.623	0.101	0.101	0.024

Knowledge of Facts and Concepts Subtest (38 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E2M	0.533	0.055	-0.008	0.031	0.134	0.018
E5	0.867	0.077	-1.685	0.170	0.122	0.051
E8	0.570	0.086	0.237	0.063	0.124	0.026
E11	0.488	0.076	-0.556	0.100	0.136	0.032
E14	0.749	0.115	-0.248	0.067	0.113	0.030
E17M	0.222	0.036	-0.251	0.050	0.162	0.020
E20	0.570	0.075	-0.[illegible]3	0.085	0.123	0.033
E23	0.532	0.082	-0.520	0.095	0.117	0.024
E26	0.785	0.104	-0.514	0.089	0.124	0.032
E29M	0.383	0.050	1.139	0.154	0.144	0.014
E32	0.398	0.102	3.985	1.036	0.088	0.013
E35	0.469	0.075	1.807	0.297	0.117	0.018
E38	0.354	0.059	0.442	0.088	0.135	0.026
E41	0.519	0.076	-0.107	0.052	0.123	0.029
E44	0.410	0.071	1.951	0.347	0.128	0.018
M5D	0.306	0.044	-1.626	0.239	0.149	0.026
M8	0.469	0.089	3.536	0.677	0.065	0.010
M11	0.668	0.068	-1.708	0.181	0.128	0.043
M14D	0.354	0.048	2.315	0.318	0.158	0.011
M20	0.375	0.059	0.650	0.111	0.135	0.020
M23D	0.268	0.039	0.591	0.091	0.150	0.017
M26	0.405	0.104	3.974	1.029	0.075	0.012
M32	0.590	0.086	0.744	0.118	0.133	0.019
M35	0.576	0.083	1.141	0.174	0.139	0.016
M38D	0.464	0.051	0.811	0.096	0.139	0.015
M41	0.549	0.082	-0.298	0.061	0.135	0.026
M44	0.501	0.077	1.462	0.231	0.125	0.016
D2	0.657	0.086	0.096	0.051	0.118	0.027
D8	0.787	0.091	0.517	0.080	0.101	0.022
D11	0.541	0.071	0.752	0.110	0.128	0.021
D17	0.554	0.069	1.132	0.151	0.120	0.020
D20	0.500	0.066	1.760	0.241	0.126	0.017
D26	0.225	0.046	-2.878	0.599	0.161	0.044
D29	0.431	0.054	1.098	0.147	0.114	0.021
D32	0.289	0.056	2.134	0.417	0.146	0.020
D35	0.710	0.076	2.065	0.241	0.085	0.017
D41	0.556	0.066	1.574	0.196	0.119	0.018
D44	0.759	0.094	0.419	0.074	0.115	0.023

Higher Level Thinking Subtest (36 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E3	0.541	0.076	-0.612	0.100	0.085	0.033
E6	0.442	0.073	-0.328	0.071	0.091	0.031
E9	0.631	0.103	0.104	0.054	0.081	0.026
E12	0.430	0.069	-0.139	0.051	0.086	0.029
E15	0.546	0.078	1.716	0.254	0.068	0.016
E18	0.462	0.077	-0.037	0.048	0.085	0.029
E21M	0.490	0.056	2.013	0.235	0.065	0.010
E24	0.410	0.069	-0.152	0.053	0.092	0.029
E27M	0.327	0.042	-0.244	0.042	0.094	0.020
E30	0.311	0.060	1.399	0.276	0.092	0.022
E33M	0.306	0.048	2.015	0.321	0.085	0.013
E36	0.356	0.073	2.599	0.541	0.083	0.017
E39M	0.402	0.058	2.241	0.325	0.067	0.011
E42	0.328	0.088	3.549	0.957	0.063	0.015
E45	0.5C	0.080	-0.342	0.073	0.085	0.031
M3	0.323	0.058	-0.552	0.105	0.097	0.026
M6	0.437	0.067	-0.704	0.115	0.091	0.028
M9D	0.452	0.049	-0.435	0.055	0.090	0.021
M120	0.354	0.044	-1.613	C.206	0.097	0.027
M150	0.190	0.039	3.103	0.641	0.092	0.012
M18	C 430	0.072	-0.254	0.056	0.092	0.025
M24	0.257	0.054	1.035	0.222	0.102	0.020
M30	0.305	0.063	1.674	0.351	0.094	0.017
M42	0.352	0.087	3.446	0.858	0.062	0.012
M450	0.328	0.052	2.754	0.438	0.083	0.011
O3	0.495	0.073	-0.468	0.082	0.092	0.030
D6	0.325	0.059	2.271	0.418	0.093	0.018
O18	0.383	0.056	1.529	0.231	0.080	0.019
O21	0 574	0.074	-0.310	0.060	0.088	0.029
O24	0.824	0.100	0.395	0.072	0.086	0.020
D27	0 537	0.073	-1.440	0.203	0.091	0.041
D30	0.314	0.056	5.142	1.412	0.044	0.011
O33	0.493	0.073	-0.933	0.146	0.094	0.035
D36	0.576	0.075	-1.227	0.168	0.092	0.038
O39	0.587	0.070	0.812	[illegible]	0.075	0.020
O42	0.408	0.061	2.006	0.309	0.079	0.017

* $p < .05$
** $p < .01$

FORM 6

ITEM PARAMETER ESTIMATES
EIGHT SUBTESTS

Numbers Subtest (34 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.581	0.089	-0.403	0.081	0.121	0.033
E2	0.469	0.070	-1.448	0.222	0.127	0.043
E3	0.484	0.079	0.627	0.116	0.135	0.024
E4	0.588	0.098	0.008	0.053	0.118	0.029
E5	0.382	0.064	-0.387	0.081	0.126	0.033
E6	0.464	0.079	-0.222	0.063	0.124	0.032
E7	0.657	0.106	0.392	0.085	[illegible]	0.025
E8M	0.458	0.046	-1.579	0.165	[illegible]	0.030
E9	0.607	0.100	0.280	0.072	[illegible]	0.026
E10	0.582	0.097	0.913	0.164	0.120	0.022
E11	0.477	0.075	-1.436	0.233	0.126	0.043
E12	0.548	0.089	-0.103	0.055	0.119	0.030
M1	0.679	0.076	-0.360	0.058	0.126	0.025
M2	0.394	0.054	-1.965	0.276	0.134	0.038
M3	0.493	0.055	-0.639	0.081	0.124	0.027
M4	0.646	0.075	0.696	0.092	0.099	0.017
M5	0.478	0.061	0.497	0.075	0.110	0.020
M6	0.421	0.057	0.113	0.041	0.142	0.022
M7	0.676	0.080	-0.151	0.045	0.119	0.023
M9D	0.675	0.051	0.599	0.056	0.087	0.014
M10	0.579	0.070	-0.128	0.043	0.131	0.023
M11	0.503	0.059	-1.994	0.240	0.127	0.042
M12	0.783	0.067	-0.969	0.095	0.113	0.033
O1	0.681	[illegible]	0.463	0.069	0.107	0.022
O2	0.437	0.054	1.044	0.138	0.119	0.020
O3	0.341	0.052	-2.127	0.328	0.132	0.043
O4	[illegible]	0.064	-0.869	0.113	0.120	0.035
O5	0.793	0.084	0.216	0.053	0.091	0.024
O6	0.850	0.106	-0.040	0.052	0.124	0.025
O7	0.730	0.069	0.932	0.103	0.106	0.018
O8	0.812	0.078	0.595	0.077	0.092	0.020
O10	0.706	0.084	0.124	0.050	0.111	0.025
O11	0.460	0.060	-1.401	0.189	0.125	0.039
O12	0.682	0.077	-0.845	0.109	0.122	0.036

Algebra Subtest (21 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E28	0.487	0.093	-0.590	0.124	0.119	0.034
E29	0.315	0.086	2.151	0.591	0.136	0.019
E30M	0.296	0.050	1.487	0.255	0.140	0.014
E31	0.466	0.092	-0.593	0.128	0.121	0.034
E32M	0.514	0.064	0.429	0.063	0.120	0.016
E33	0.569	0.127	0.171	0.068	0.117	0.027
E34M	0.531	0.059	-0.534	0.067	0.117	0.022
E35	0.453	0.122	2.592	0.708	0.099	0.016
E36	0.443	0.102	0.561	0.141	0.123	0.026
M28	0.673	0.095	-0.098	0.044	0.113	0.023
M29	0.308	0.054	0.547	0.104	0.130	0.021
M310	0.454	0.057	3.426	0.441	0.080	0.008
M33D	0.661	0.066	-0.282	0.042	0.111	0.020
M35	0.677	0.089	-0.525	0.081	0.111	0.028
M360	0.625	[illegible]	0.429	0.050	0.098	0.016
O28	0.807	0.088	-1.592	0.188	0.114	0.050
O29	0.452	0.062	2.323	0.325	0.087	0.017
O30	0.562	0.076	-0.793	0.118	0.117	0.035
O32	0.840	0.083	0.727	0.092	0.089	0.022
O34	0.297	0.047	-0.090	0.044	0.129	0.029
O35	0.685	0.090	-0.460	0.079	0.110	0.034

Geometry Subtest (21 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E37	1.149	0.157	0.382	0.096	0.163	0.023
E38M	0.744	0.067	-0.400	0.051	0.177	0.022
E39	1.197	0.143	0.382	0.091	0.137	0.023
E40M	0.971	0.074	1.678	0.149	0.159	0.010
E41	1.161	0.170	0.668	0.137	0.201	0.021
E42	0.828	0.136	0.627	0.132	0.247	0.023
E43M	0.647	0.066	1.357	0.148	0.206	0.012
E44	0.757	0.103	0.302	0.076	0.190	0.025
E45M	0.454	0.053	1.126	0.139	0.206	0.014
M370	[illegible]	0.056	1.942	0.170	0.195	0.010
M39	0.590	0.093	0.507	0.093	0.215	0.020
M410	0.614	0.074	0.027	0.034	0.223	0.018
M42	0.662	0.123	2.837	0.549	0.165	0.012
M44	0.884	0.100	1.446	0.182	[illegible]	0.014
O38	0.966	0.075	1.165	0.117	[illegible]	0.017
D39	1.008	0.090	0.975	0.113	0.192	0.018
O40	0.508	0.074	-0.371	0.072	0.218	0.031
O42	1.067	0.131	0.451	0.086	0.195	0.022
O43	1.433	0.117	0.882	0.116	0.190	0.018
O44	1.231	0.114	0.799	0.110	0.201	0.020
D45	0.967	0.139	0.141	0.064	[illegible]	0.026

Measurement Subtest (22 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E13	0.750	0.117	0.658	0.126	0.204	0.021
E14M	1.006	0.107	0.080	0.043	0.197	0.017
E15	0.676	0.167	2.773	0.720	0.188	0.015
E16	1.048	0.162	0.933	0.175	0.166	[illegible]
E17	0.810	0.144	-0.069	0.068	0.229	0.027
E18M	0.813	0.082	0.347	0.055	0.241	0.015
E19M	0.706	0.068	0.164	0.041	0.216	0.017
E20	0.776	0.147	0.994	0.211	0.240	0.020
E21	0.557	0.103	0.856	0.176	0.274	0.022
M13D	0.650	0.064	0.001	0.034	0.235	0.018
M15	0.810	0.094	0.114	0.051	0.222	0.022
M16	0.708	0.065	1.347	0.138	0.188	0.015
M17	1.072	0.094	0.783	0.095	0.220	0.016
M20D	0.728	0.067	2.567	0.257	0.221	0.009
M21	0.701	0.084	0.043	0.047	0.215	0.024
O14	0.534	0.066	0.392	0.070	0.225	0.025
O15	1.198	0.106	1.164	0.144	0.241	0.017
O16	0.707	0.074	0.928	0.115	[illegible]	0.020
O17	1.385	0.137	0.865	0.129	[illegible]	0.017
D18	1.042	0.085	1.568	0.162	0.181	0.015
O19	0.724	0.112	-0.842	0.142	0.221	0.039

Probability and Statistics Subtest (13 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.	
D21	0.967	0.100	0.830	0.111	0.218	0.019	
E22	0.410	0.118	3.097	0.900	0.082	0.014	
E23	0.369	0.108	3.049	0.903	0.0[illegible]7	0.016	*
E24	0.752	0.213	0.406	0.130	[illegible]	0.025	
E25	0.425	0.084	-1.383	0.280	[illegible]	0.041	
E26	0.413	0.086	-1.042	0.224	0.110	0.038	
E27M	0.380	0.059	0.902	0.145	0.108	0.015	**
M22D	0.397	0.049	1.661	0.208	0.133	0.012	*
M23D	0.373	0.047	-0.409	0.059	0.113	0.020	
M240	0.723	0.082	-0.361	0.052	0.099	0.0[illegible]1	
M25	0.514	0.077	-0.294	0.059	0.105	0.024	
M2[illegible]D	0.785	0.067	0.794	0.077	0.076	0.013	**
D25	0.309	0.066	3.664	0.784	0.097	0.014	
027	0.560	0.081	0.140	0.050	0.[illegible]02	0.028	

Procedural Skills Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.	
E1	0.452	0.070	-0.392	0.079	0.160	0.032	
E4	0.640	0.101	0.006	0.056	0.142	0.029	
E7	0.564	0.090	0.500	0.098	0.147	0.024	
E10	0.605	0.090	0.842	0.140	0.128	0.022	*
E13	0.854	0.109	0.453	0.086	0.118	0.022	
E16	0.423	0.090	2.196	0.474	0.158	0.018	
E19M	0.478	0.048	-0.007	0.032	0.162	0.018	
E22	0.399	0.126	3.725	1.184	0.119	0.014	
E25	0.32[illegible]	0.055	-1.519	0.268	0.166	0.041	
E28	0.6[illegible]	0.095	-0.387	0.079	0.143	0.033	
E31	[illegible]	0.064	-0.405	0.086	0.166	0.032	
E34M	0.[illegible]6	0.040	-0.509	0.062	0.162	0.021	
E37	0.989	0.162	0.293	0.084	0.121	0.024	
E40M	0.636	0.065	2.034	0.217	0.143	0.010	
E43M	0.488	0.050	1.244	0.133	0.147	0.013	
M1	0.657	0.067	-0.352	0.055	0.145	0.025	
M4	0.700	0.075	0.856	0.105	0.149	0.016	
M7	0.579	0.061	-0.121	0.042	0.141	0.023	
M10	0.813	0.088	-0.110	0.047	0.147	0.022	
M13D	1.036	0.083	-0.280	0.043	0.118	0.019	
M16	0.666	0.070	0.865	0.102	0.116	0.016	
M22D	0.377	0.045	2.233	0.273	0.193	0.011	
M25	0.676	0.063	-0.165	0.044	0.123	0.023	
M28	0.486	0.053	-0.083	0.040	0.140	0.023	
M31D	0.596	0.057	2.982	0.295	0.092	0.008	
M37D	0.499	0.043	1.830	0.164	0.127	0.011	
01	0.969	0.104	0.523	0.080	0.126	0.021	
04	0.614	0.079	-0.593	0.090	0.159	0.034	
07	0.904	0.077	1.081	0.113	0.149	0.017	
D10	0.839	0.100	0.278	0.062	0.1[illegible]1	0.024	
D16	0.5[illegible]6	0.062	0.982	0.122	0.168	0.020	
D19	0.509	0.078	-1.151	0.184	0.155	0.040	
025	0.364	0.071	3.753	0.744	0.141	0.014	
D28	0.688	0.093	-1.677	0.236	0.149	0.052	
D34	0.410	0.056	0.104	0.047	0.1[illegible]	0.028	
040	0.358	0.052	-0.684	0.109	0.162	0.033	
043	0.606	0.065	1.242	0.147	0.165	0.019	

Knowledge of Facts and Concepts Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E2	0.331	0.061	-1.955	0.364	0.181	0.043
E5	0.345	0.068	-0.433	0.100	0.184	0.031
E8M	0.329	0.043	-1.963	0.258	0.184	0.029
E11	0.537	0.070	-1.503	0.204	0.168	0.043
E14M	0.777	0.073	-0.[illegible]16	0.037	0.149	0.018
E17	0.569	0.090	-0.304	0.073	0.162	0.030
E20	0.676	0.138	0.558	0.133	0.157	0.022
E23	0.533	0.133	2.556	0.650	0.145	0.015
E26	0.622	0.080	0.918	0.132	0.170	0.037
E29	0.325	0.088	2.512	0.686	0.188	0.018
E32M	0.658	0.068	0.463	0.061	0.169	0.015
E35	0.530	0.130	2.301	0.576	0.117	0.016
E38M	0.700	0.062	-0.502	0.056	0.168	0.021
E41	0.545	0.114	0.602	0.141	0.162	0.024
E44	0.452	0.080	0.134	0.059	0.165	0.027
M2	0.412	0.056	-1.748	0.244	0.174	0.037
M5	0.573	0.069	0.560	0.080	0.138	0.019
M11	0.679	0.064	-1.536	0.155	0.160	0.041
M17	0.522	0.072	0.922	0.137	0.196	0.017
M200	0.560	0.[illegible]52	2.414	0.235	0.174	0.010
M230	0.335	0.036	-0.113	0.021	0.179	0.019
M26D	0.769	0.050	1.050	0.079	0.125	0.0[illegible]2
M29	0.362	0.056	0.688	[illegible]114	0.173	0.020
M35	0.800	0.092	-0.400	[illegible]065	0.148	0.027
M410	0.637	0.059	-0.080	[illegible]033	0.162	0.019
M44	0.325	0.069	2.918	0.621	0.168	0.0[illegible]4
D2	0.427	0.052	1.459	0.184	0.162	0.020
D5	0.700	0.072	0.551	0.076	0.148	0.023
08	0.700	0.067	0.969	[illegible].108	0.141	0.020
D11	0.721	0.104	-0.757	0.122	0.160	0.038
D14	0.572	0.062	0.305	0.058	0.152	0.026
D17	0.523	0.061	1.243	0.[illegible]54	0.171	0.020
D29	0.578	0.059	2.238	0.243	0.116	0.017
032	0.637	0.062	1.070	0.118	0.141	0.021
D35	0.600	0.077	-0.327	0.065	0.160	0.033
D38	0.683	0.058	1.362	0.130	0.132	0.018
D44	0.545	0.060	1.095	0.132	0.156	0.022

Higher Level Thinking Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E3	0.606	0.095	0.685	0.129	0.236	0.022
E6	0.611	0.099	-0.077	0.063	0.245	0.028
E9	0.611	0.093	0.492	0.102	0.245	0.023
E12	0.752	0.117	-0.117	0.066	0.217	0.028
E15	0.642	0.149	2.550	0.618	0.177	0.015
E18M	0.855	0.072	-0.038	0.037	0.165	0.017
E21	0.578	0.099	0.504	0.110	0.232	0.024
E24	0.723	0.118	0.625	0.125	0.202	0.021
E27M	0.832	0.075	0.609	0.070	0.175	0.013
E30M	0.555	0.086	2.045	0.328	0.313	0.011
E33	0.754	0.116	0.229	0.077	0.204	0.025
E36	0.602	0.101	0.702	0.138	0.223	0.023
E39	0.976	0.150	0.329	0.092	0.170	0.022
E42	0.854	0.152	0.194	0.082	0.214	0.025
E45M	0.458	0.056	1.102	0.141	0.225	0.014
M3	0.840	0.101	-0.291	0.059	0.222	0.024
M6	0.387	0.062	0.728	0.127	0.264	0.019
M90	0.839	0.052	0.846	0.066	0.160	0.013
M12	0.816	0.075	-0.831	0.091	0.196	0.031
M15	0.720	0.085	-0.125	0.047	0.206	0.023
M21	0.646	0.076	-0.180	0.048	0.205	0.024
M240	0.808	0.066	-0.043	0.036	0.206	0.018
M330	0.876	0.069	-0.042	0.037	0.187	0.018
M360	0.797	0.054	0.687	0.061	0.191	0.014
M39	0.742	0.086	0.210	0.052	0.177	0.021
M42	0.718	0.100	2.288	0.337	0.151	0.012
O3	0.544	0.067	-0.997	0.135	0.221	0.040
O6	1.372	0.141	0.309	0.073	0.167	0.024
O12	0.712	0.088	-0.379	0.071	0.213	0.035
O15	0.990	0.074	1.599	0.152	0.249	0.016
O18	0.741	0.062	2.253	0.210	0.191	0.015
O21	0.764	0.062	1.083	0.106	0.190	0.020
O27	0.993	0.092	0.621	0.087	0.252	0.022
O30	0.849	0.103	-0.223	0.062	0.213	0.032
O39	0.582	0.054	1.747	0.175	0.222	0.018
O42	0.800	0.075	1.129	0.127	0.283	0.020
O45	0.772	0.072	0.332	0.061	0.185	0.027

* $p < .05$
** $p < .01$

FORM 7

ITEM PARAMETER ESTIMATES
EIGHT SUBTESTS

Numbers Subtest (31 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	1.022	0.134	-0.358	0.079	0.182	0.031
E2	0.528	0.081	0.170	0.062	0.252	0.026
E3M	0.627	0.076	1.942	0.251	0.356	0.011
E4M	0.875	0.079	0.398	0.056	0.226	0.014
E5	0.947	0.126	-0.284	0.073	0.196	0.029
E6	0.834	0.137	0.513	0.110	0.228	0.021
E7	0.678	0.127	1.327	0.267	0.309	0.019
E9	0.788	0.118	1.282	0.214	0.220	0.017
E10	1.060	0.136	-0.449	0.086	0.187	0.032
E11	0.954	0.092	-1.201	0.136	0.224	0.045
E12	0.554	0.085	-0.128	0.059	0.251	0.028
M1O	0.600	0.050	-1.192	0.106	0.236	0.028
M2	0.820	0.093	0.285	0.060	0.200	0.020
M5	1.180	0.112	0.983	0.125	0.231	0.014
M6O	0.825	0.071	-0.434	0.053	0.203	0.022
M7	0.590	0.074	1.041	0.143	0.266	0.017
M8	0.727	0.103	2.263	0.348	0.333	0.013
M9	1.023	0.076	1.558	0.143	0.131	0.012
M10	0.744	0.079	-0.372	0.061	0.210	0.026
M11	[illegible]	0.064	-1.317	0.146	0.238	0.036
M12	0.665	0.080	-0.057	0.048	0.245	0.023
D2	0.626	0.083	-0.034	0.053	0.259	0.029
D3	0.743	0.075	0.888	0.110	0.247	0.021
D4	0.757	0.093	-0.471	0.080	0.227	0.035
D5	1.244	0.097	0.714	0.089	0.149	0.021
D7	1.005	0.107	0.436	0.078	0.216	0.023
D8	0.948	0.108	-1.617	0.203	0.233	0.060
D9	0.785	0.079	0.915	0.113	0.243	0.020
D10	0.907	0.086	0.339	0.066	0.184	0.025
D11	0.624	0.095	-1.453	0.231	0.244	0.048
D12	0.806	0.109	-0.203	0.064	0.246	0.031

Algebra Subtest (24 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E19	0.497	0.080	0.132	0.055	0.162	0.027
E20	0.958	0.161	0.404	0.095	0.126	0.022
E21	0.564	0.094	0.454	0.094	0.170	0.024
E22	0.511	0.088	1.248	0.226	0.178	0.020
E23	0.606	0.088	-0.764	0.123	0.159	0.036
E24	0.599	0.102	0.281	0.073	0.169	0.025
E25M	0.451	0.051	0.526	0.069	0.176	0.016
E26M	0.637	0.065	0.326	0.049	0.148	0.017
[illegible]	0.628	0.096	-0.587	0.105	0.161	0.034
M19	0.583	0.075	0.359	0.064	0.165	0.021
M20	0.616	0.082	3.060	0.424	0.081	0.010
M21D	0.594	0.068	-0.322	0.049	0.178	0.021
M22	0.688	0.093	-0.364	0.066	0.164	0.027
M23	0.568	0.078	2.529	0.359	0.143	0.012
M24	0.494	0.068	0.519	0.084	0.167	0.021
M27	0.831	0.076	1.385	0.142	0.114	0.015
D19	0.724	0.106	-0.877	0.140	[illegible]	0.038
D20	0.849	0.110	0.607	0.098	[illegible]	0.021
D22	0.537	0.079	0.844	0.135	0.175	0.021
D23	0.769	0.117	-0.402	0.082	0.149	0.033
D24	0.466	0.067	0.775	0.122	0.164	0.022
D25	0.655	0.094	[illegible]	0.344	0.180	0.016
D26	0.696	0.086	2.194	0.292	0.134	0.015
D27	0.753	0.123	-0.116	0.057	0.156	0.030

Geometry Subtest (22 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E28	0.473	0.092	1.388	0.280	0.207	0.021
E29	0.404	0.087	1.192	0.265	0.236	0.023
E30M	0.479	0.071	0.527	0.086	0.207	0.016
E31	0.760	0.158	0.171	0.071	0.175	0.027
E32	0.702	0.126	0.685	0.139	0.176	0.024
E33	0.414	0.099	2.780	0.671	0.195	0.017
E34M	0.548	0.076	2.284	0.326	0.190	0.010
E35M	0.576	0.075	1.589	0.214	0.216	0.012
E36	0.614	0.120	-0.400	0.097	0.200	0.034
M28	0.417	0.087	1.413	0.300	0.229	0.017
M29	0.556	0.103	0.761	0.150	0.201	0.019
M31O	0.364	0.056	2.566	0.398	0.218	0.011
M32	0.653	0.110	1.047	0.185	0.197	0.017
M33D	0.554	0.056	1.903	0.201	0.170	0.011
M36	0.524	0.093	1.329	0.244	0.192	0.017
D28	0.891	.110	0.471	0.085	0.156	0.023
D29	0.547	0.073	0.619	0.098	0.206	0.023
D30	0.685	0.091	0.073	0.055	0.185	0.028
D32	0.481	0.076	-0.316	0.070	0.209	0.031
D34	0.694	0.110	-0.070	0.055	0.200	0.028
D35	0.648	0.077	1.137	0.152	0.186	0.021
D36	0.539	0.084	1.300	0.152	0.163	0.019

Measurement Subtest (22 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E37M	0.968	0.081	-0.071	0.039	0.159	0.017
E38M	[illegible]	0.077	2.104	0.231	0.218	0.010
E39	0.893	0.107	-0.428	0.080	0.171	0.031
E40	0.673	0.085	0.704	0.108	0.151	0.021
E41	1.638	0.227	0.366	0.106	0.114	0.019
E42	0.681	0.102	1.143	0.191	0.239	0.019
E43	1.295	0.196	0.437	0.109	0.159	0.020
E44	1.396	0.121	1.236	0.161	0.097	0.014
E45M	0.905	0.062	1.221	0.101	0.162	0.011
M39D	0.982	0.057	0.314	0.041	0.106	0.016
M40	0.852	0.088	2.165	0.251	0.169	0.011
M41	0.869	0.132	2.753	0.466	0.203	0.011
M42	1.053	0.084	1.268	0.130	0.192	0.013
M43	0.834	0.089	0.534	0.078	0.181	0.018
M44D	0.972	0.062	0.332	0.043	0.131	0.016
D37	1.314	0.086	2.574	0.242	0.051	0.010
D38	0.649	0.062	1.027	0.113	0.191	0.021
D40	2.197	0.109	1.129	0.133	0.105	0.014
D41	1.196	0.086	1.779	0.174	0.205	0.015
D42	1.730	0.085	1.233	0.116	0.115	0.015
D43	0.636	0.059	1.747	0.178	0.202	0.017
D45	0.969	0.088	0.356	0.065	0.153	0.026

Probability and Statistics Subtest (13 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E13	0.633	0.092	-1.185	0.182	0.091	0.041
E14	0.829	0.122	0.711	0.122	0.075	0.020
E15M	0.266	0.045	0.898	0.155	0.110	0.016
E16	0.254	0.065	2.858	0.741	0.108	[illegible]
E17	0.920	0.103	1.138	[illegible]	0.060	[illegible]
E18	0.646	0.112	-0.054	0.052	0.086	0.028
M130	0.232	0.056	3.426	0.685	0.090	0.010
M140	0.345	0.049	0.562	0.085	0.112	0.016
M16D	0.668	0.086	-0.094	0.034	0.089	0.019
M170	0.638	0.055	2.221	0.200	0.051	0.008
M18	0.568	0.109	0.311	0.072	0.089	0.020
O15	0.599	0.107	-0.799	0.152	0.092	0.036
O18	0.515	0.093	-0.641	0.125	0.096	0.034

Procedural Skills Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.791	0.088	-0.577	0.085	0.139	0.031
E4M	0.605	0.056	0.153	0.035	0.133	0.016
E7	0.403	0.074	0.745	0.147	0.173	0.023
E10	0.625	0.075	-0.714	0.100	0.151	0.032
E13	0.853	0.072	-1.196	0.119	0.141	0.040
E16	0.348	0.093	2.939	0.799	0.137	0.017
E19	0.594	0.079	-0.126	0.055	0.148	0.026
E22	0.395	0.080	1.456	0.302	0.185	0.020
E25M	0.445	0.049	0.306	0.046	0.150	0.017
E28	0.411	0.078	1.140	0.225	0.181	0.020
E31	0.764	0.099	-0.186	0.061	0.139	[illegible]
E34M	0.365	0.073	3.249	0.658	0.196	0.010
E37M	[illegible]	0.058	0.011	0.033	0.175	0.017
E40	[illegible]	0.094	0.850	0.161	0.152	0.020
E43	0.924	0.148	0.308	0.082	0.106	0.022
M10	0.680	0.051	-1.204	0.098	0.139	0.030
M7	0.396	0.061	0.796	0.130	0.166	0.019
M10	0.656	0.076	-0.509	0.072	0.137	0.028
M130	0.352	0.059	3.951	0.674	0.159	0.009
M160	0.654	0.048	0.091	0.032	0.124	0.018
M19	0.568	0.075	0.364	0.066	0.179	0.020
M22	0.720	0.084	-0.478	0.071	0.132	0.028
M28	0.411	0.066	1.038	0.172	0.165	0.018
M310	0.420	0.043	1.843	0.193	0.158	0.012
M40	0.612	0.079	1.966	0.265	0.113	0.012
M43	0.494	0.071	0.641	0.103	0.153	0.020
O4	0.730	0.085	-0.573	0.085	0.139	0.036
O7	0.660	0.069	0.401	0.065	0.150	0.025
O10	0.738	0.072	0.308	0.058	0.121	0.026
O19	0.857	0.104	-0.603	0.093	0.131	0.038
O22	0.616	0.060	0.977	0.109	0.163	0.020
O25	0.454	0.072	3.055	0.497	0.172	0.016
O28	0.868	0.085	0.634	0.085	0.145	0.022
O34	0.639	0.074	0.040	0.050	0.165	0.028
O37	0.607	0.080	3.374	0.535	0.050	0.010
O40	1.197	0.069	1.245	0.101	0.075	0.016
O43	0.466	0.049	1.620	0.178	0.131	0.019

Knowledge of Facts and Concepts Subtest (38 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E2	0.377	0.063	-0.117	0.051	0.153	0.029
E5	0.710	0.086	-0.397	0.072	0.115	0.031
E11	0.572	0.071	-1.668	0.215	0.131	0.046
E14	0.643	0.086	0.981	0.145	0.125	0.019
E17	0.589	0.075	1.543	0.206	0.083	0.018
E20	0.780	0.114	0.502	0.095	0.118	0.021
E23	0.531	0.074	-0.842	0.129	0.136	0.036
E26M	0.502	0.054	0.255	0.042	0.126	0.017
E29	0.337	0.059	0.722	0.137	0.147	0.025
E32	[illegible]	0.113	0.459	0.093	0.127	0.023
E35M	0.254	0.046	2.460	0.450	0.164	0.013
E38M	0.401	0.057	2.363	0.339	0.143	0.011
E41	0.767	0.096	0.752	0.112	0.094	0.021
E44	0.628	0.085	1.998	0.284	0.073	0.016
M2	0.674	0.095	0.112	0.046	0.132	0.021
M5	0.680	0.090	0.818	0.119	0.139	0.016
M8	0.297	0.060	1.970	0.402	0.180	0.016
M11	0.557	0.060	-1.610	0.179	0.131	0.039
M140	0.501	0.050	0.563	0.064	0.145	0.015
M170	0.817	0.047	1.954	0.125	0.057	0.007
M20	0.487	0.098	3.377	0.689	0.074	0.010
M23	0.384	0.085	3.062	0.687	0.131	0.013
M29	0.387	0.057	0.712	0.113	0.145	0.019
M32	0.910	0.121	0.475	0.081	0.103	0.018
M41	[illegible]	0.081	2.157	0.336	0.116	0.012
M440	0.453	0.043	0.437	0.052	0.131	0.016
O2	0.399	0.062	-0.561	0.098	0.146	0.032
O5	0.717	0.070	0.769	0.092	0.106	0.021
O8	0.674	0.088	-2.230	0.302	0.130	0.058
O11	0.407	0.066	-2.357	0.386	0.138	0.050
O20	0.486	0.060	1.132	0.150	0.158	0.020
O23	0.630	0.089	-0.383	0.074	0.124	0.033
O26	0.407	0.065	3.043	0.495	0.109	0.015
O29	0.440	0.055	0.435	0.077	0.138	0.025
O32	0.799	0.126	-0.298	0.071	0.125	0.031
O35	0.504	0.063	1.144	0.154	0.131	0.022
O38	0.517	0.059	0.798	0.104	0.128	0.022
O41	0.389	0.058	2.401	0.363	0.128	0.017

Higher Level Thinking Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E3M	0.385	0.055	1.543	0.226	0.265	0.013
E6	0.726	0.104	0.616	0.110	0.213	0.022
E9	0.697	0.094	1.092	0.163	0.160	0.019
E12	0.617	0.084	-0.253	0.064	0.196	0.030
E15M	0.360	0.052	1.733	0.257	0.269	0.013
E18	0.781	0.115	0.116	0.062	0.185	0.026
E21	0.781	0.115	0.308	0.074	0.161	0.025
E24	0.812	0.128	0.346	0.085	0.204	0.024
E27	0.529	0.075	-0.462	0.084	0.210	0.032
E30M	0.440	0.050	0.553	0.073	0.221	0.016
E33	0.580	0.106	2.292	0.434	0.209	0.016
E36	0.623	0.090	-0.429	0.083	0.206	0.033
E39	0.802	0.126	-0.213	0.070	0.196	0.031
E42	0.568	0.097	1.538	0.276	0.246	0.019
E45M	0.509	0.068	2.228	0.305	0.203	0.01[illegible]
M6D	0.773	0.065	-0.489	0.055	0.193	0.022
M9	1.180	0.098	1.248	0.133	0.120	0.011
M12	0.664	0.079	-0.28[illegible]	0.056	0.205	0.024
M18	0.894	0.121	0.520	0.092	0.211	0.017
M210	0.485	0.048	-0.272	0.042	0.218	0.020
M24	0.569	0.077	0.394	0.071	0.202	0.020
M27	0.722	0.085	1.670	0.212	0.169	0.014
M330	0.636	0.054	1.619	0.120	0.191	0.010
M36	0.492	0.075	1.530	0.242	0.222	0.016
M390	0.836	0.059	0.408	0.047	0.158	0.015
M42	1.120	0.119	1.069	0.142	0.192	0.014
O3	0.716	0.066	0.713	0.085	0.183	0.023
O9	0.914	0.086	0.856	0.104	0.221	0.020
O12	0.863	0.105	-0.238	0.064	0.191	0.033
O15	0.581	0.069	-0.464	0.074	0.204	0.034
O18	0.585	0.066	-0.222	0.056	0.204	0.032
O24	0.802	0.076	1.015	0.116	0.224	0.020
O27	0.712	0.082	0.208	0.058	0.196	0.028
O30	0.671	0.074	0.368	0.067	0.218	0.026
O36	0.863	0.074	[illegible].630	0.166	0.195	0.017
O42	0.996	0.067	1.529	0.130	0.126	0.016
O45	1.114	0.108	0.336	0.070	0.150	0.026

* $p < .05$
** $p < .01$

FORM 8

ITEM PARAMETER ESTIMATES
EIGHT SUBTESTS

Numbers Subtest (32 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.610	0.071	-1.230	0.155	0.172	0.042
E2	0.824	0.089	-0.960	0.121	0.157	0.040
E3	0.737	0.096	-0.291	0.067	0.148	0.031
E4	1.022	0.150	0.379	0.089	0.155	0.021
E5	0.664	0.087	1.203	0.172	0.143	0.019
E6M	0.586	0.051	0.487	0.055	0.172	0.015
E7	0.587	0.078	-0.218	0.060	0.171	0.029
E8	0.322	0.059	0.734	0.145	0.201	0.025
E9M	0.622	0.063	2.130	0.229	0.189	0.010
E10	0.753	0.100	-0.499	0.087	0.159	0.033
E11	0.940	0.129	-0.236	0.069	0.145	0.029
E12	0.734	0.105	0.137	0.062	0.185	0.025
M10	0.433	0.043	0.757	0.083	0.179	0.015
M2	0.560	0.055	-1.372	0.144	0.176	0.036
M3	0.797	0.076	-0.492	0.066	0.160	0.027
M4	0.724	0.071	0.623	0.078	0.162	0.017
M5	0.727	0.081	0.791	0.105	0.202	0.016
M7	0.982	0.093	0.626	0.083	0.159	0.015
M8	0.445	0.053	-0.901	0.115	0.189	0.029
M10	1.461	0.204	-0.009	0.064	0.145	0.020
M11	0.686	0.067	-0.072	0.044	0.155	0.023
M120	0.949	0.078	-0.145	0.039	0.153	0.019
O2	0.667	0.081	0.894	0.123	0.179	0.021
O3	0.482	0.067	0.856	0.131	0.178	0.024
O4	0.480	0.077	-1.335	0.221	0.179	0.043
O5	0.556	0.067	1.326	0.171	0.155	0.020
O6	0.2[illegible]	0.052	0.956	0.181	0.210	0.025
O7	0.655	0.091	0.048	0.052	0.162	0.030
O8	0.698	0.104	-0.238	0.063	0.165	0.033
O9	0.921	0.089	1.310	0.150	0.162	0.017
O10	.541	0.073	1.115	0.161	0.178	0.022
O11	[illegible]	0.109	-0.226	0.063	0.169	0.032

Algebra Subtest (21 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E19M	0.723	0.062	1.011	0.097	0.130	0.013
E20	0.971	0.174	1.300	0.257	0.095	0.015
E21M	0.401	0.097	4.559	1.120	0.122	0.009
E22M	0.850	0.093	-0.369	0.055	0.149	0.022
E23M	0.819	0.072	1.189	0.118	0.212	0.012
E24	0.509	0.123	1.669	0.412	0.152	0.018
E25	0.516	0.107	0.237	0.074	0.168	0.025
E26M	0.634	0.061	0.859	0.091	0.140	0.014
E27	0.351	0.067	-1.176	0.230	0.174	0.036
M200	0.334	0.039	0.635	0.081	0.175	0.017
M24	0.542	0.065	2.036	0.255	0.187	0.015
M25	0.899	0.098	0.547	0.079	0.137	0.021
M27	0.430	0.057	1.638	0.225	0.174	0.017
O19	1.005	0.165	-0.194	0.070	0.135	0.030
O21	0.478	0.098	3.446	0.722	0.13[illegible]	0.014
O22	0.893	0.096	0.977	0.126	0.138	0.018
O23	0.715	0.107	-0.306	0.071	0.155	0.031
O24	0.446	0.065	1.025	0.158	0.168	0.022
O25	0.642	0.088	2.441	0.353	0.119	0.015
O26	0.467	0.072	2.049	0.323	0.158	0.017
O27	0.935	0.128	0.222	0.067	0.128	0.024

Geometry Subtest (21 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E28	0.768	0.088	2.006	0.247	0.055	0.014
E29	0.483	0.080	1.073	0.188	0.125	0.021
E30	0.710	0.104	0.856	0.140	0.097	0.021
E31	0.429	0.082	2.054	0.398	0.119	0.018
E32	0.716	0.110	-0.511	0.096	0.103	0.034
E33	0.530	0.084	1.282	0.213	0.114	0.020
E34	0.707	0.118	-0.150	0.060	0.101	0.030
E35	0.394	0.101	3.022	0.782	0.106	0.016
E36M	0.401	0.046	-1.050	0.125	0.118	0.025
M28	0.509	0.090	2.402	0.433	0.087	0.011
M29	0.748	0.121	0.007	0.044	0.105	0.022
M300	0.459	0.046	0.855	0.093	0.107	0.014
M320	0.790	0.067	0.781	0.077	0.122	0.013
M33	0.551	0.105	2.835	0.554	0.094	0.011
M340	0.484	0.051	1.630	0.178	0.131	0.012
M350	0.569	0.054	1.214	0.122	0.128	0.013
O28	0.823	0.124	-0.444	0.088	0.105	0.035
O29	0.627	0.069	0.766	0.100	0.110	0.022
O31	0.545	0.060	1.951	0.223	0.092	0.017
O33	0.531	0.059	1.990	0.233	0.099	0.017
O36	0.648	0.071	0.359	0.064	0.105	0.026

Measurement Subtest (22 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E37	0.561	0.004	-1.551	0.008	0.082	0.008
E38	0.248	0.017	0.043	0.081	0.103	0.009
E39	0.353	0.004	1.079	0.043	0.079	0.002
E40	0.311	0.012	3.554	0.183	0.055	0.002
E41	0.338	0.006	0.901	0.039	0.081	0.004
E42	0.368	0.007	0.463	0.033	0.085	0.003
E43	0.407	0.012	0.397	0.046	0.080	0.003
E44	0.235	0.047	3.348	0.907	0.079	0.003
E45	0.378	0.029	0.528	0.127	0.083	0.004
M37	0.865	0.100	0.696	0.039	0.151	0.018
M38	0.830	0.068	1.637	0.092	0.138	0.012
M390	1.272	0.059	1.916	0.100	0.119	0.008
M400	0.675	0.046	1.683	0.101	0.134	0.010
M410	0.812	0.056	1.122	0.065	0.146	0.011
M42	0.948	0.109	0.598	0.042	0.143	0.020
M44	0.487	0.066	1.321	0.095	0.191	0.016
M450	0.565	0.049	2.426	0.188	0.192	0.009
O37	0.784	0.094	0.360	0.070	0.178	0.023
O38	0.627	0.061	0.890	0.103	0.176	0.019
O42	0.909	0.063	1.840	0.155	0.113	0.013
O43	1.049	0.150	0.233	0.071	0.161	0.025
O44	0.767	0.066	1.189	0.123	0.178	0.018

Probability and Statistics Subtest (16 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.	
E13	0.324	0.101	3.781	1.184	0.076	0.015	
E14	0.433	0.113	0.699	0.190	0.112	0.025	
E15	0.468	0.120	0.863	0.228	0.110	0.024	
E16M	0.299	0.060	0.433	0.092	0.126	0.017	**
E17	0.417	0.095	-2.513	0.579	0.125	0.053	*
E18	0.336	0.091	-0.394	0.116	0.127	0.032	
M13D	0.620	0.076	0.892	0.114	0.090	0.013	
M14	0.341	0.082	2.001	0.4[illegible]7	0.115	0.016	
M15	0.339	0.080	1.920	0.457	0.112	0.016	
M17	0.296	0.101	-5.425	1.860	0.139	0.066	
M18	0.465	0.108	-0.280	0.076	0.119	0.026	
D14	0.785	0.124	-0.917	0.157	0.110	0.040	
D15	0.403	0.077	1.048	0.207	0.121	0.022	
D16	0.263	0.066	2.303	0.582	0.115	0.020	
D17	0.380	0.083	-3.012	0.666	0.128	0.055	
D18	0.335	0.072	1.000	0.22	0.121	0.024	

Procedural Skills Subtest (36 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E1	0.485	0.064	-1.536	0.211	0.174	0.042
E4	0.547	0.085	0.534	0.101	0.172	0.0[illegible]
E7	0.766	0.099	-0.370	0.074	0.163	0.029
E10	0.[illegible]70	0.096	-0.634	0.097	0.158	0.033
E13	0.581	0.162	3.296	0.946	0.134	0.013
E16M	0.659	0.063	0.252	0.042	0.159	0.016
E19M	0.498	0.054	1.428	0.162	0.162	0.012
E22M	0.535	0.051	-0.480	0.056	0.176	0.021
E25	0.729	0.116	0.195	0.068	0.165	0.024
E28	0.743	0.120	2.048	0.343	0.086	0.014
E31	0.441	0.[illegible]08	2.537	0.635	0.190	0.016
E34	0.623	0.092	-0.166	0.060	0.176	0.028
E37	0.989	0.125	-0.463	0.036	0.152	0.031
E40	0.545	0.164	3.758	1.303	0.1[illegible]	0.013
E43	0.653	0.108	1.183	0.211	0.163	0.019
M1D	0.506	0.045	0.724	0.073	0.175	0.015
M4	0.982	[illegible]090	0.568	0.076	0.143	0.017
M7	0.894	[illegible]087	0.703	0.086	0.147	0.016
M10	1.489	0.223	0.102	0.064	0.138	0.021
M13D	0.742	0.055	1.643	0.136	0.235	0.011
M[illegible]	0.726	0.080	0.452	0.069	0.157	0.020
M2	0.650	0.093	2.760	0.415	0.139	0.011
M34	0.655	0.050	1.724	0.143	0.135	0.011
M37	0.614	0.071	0.142	0.045	0.164	0.022
M40D	0.887	0.054	1.341	0.097	0.157	0.011
D4	0.449	0.068	-1.433	0.225	0.176	0.043
D7	0.527	0.066	0.112	0.052	0.181	0.028
D10	0.845	0.081	1.156	0.136	0.219	0.019
D16	0.475	0.062	2.407	0.325	0.207	0.017
D19	[illegible].974	0.134	-0.022	0.061	0.146	0.029
D22	[illegible].702	0.056	1.301	0.121	0.139	0.018
D25	0.599	0.070	2.805	0.348	0.124	0.015
D28	0.899	0.139	-0.397	0.086	0.[illegible]31	0.034
D31	0.687	0.062	2.141	0.214	0.155	0.015
D37	0.625	0.070	0.331	0.065	0.157	0.027
D43	0.787	0.086	0.292	0.067	0.160	0.026

Knowledge of Facts and Concepts Subtest (39 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E2	0.538	0.073	-1.224	0.176	0.160	0.041
E5	0.664	0.110	1.177	0.209	0.144	0.019
E8	0.336	0.069	0.590	0.131	0.187	0.025
E11	0.494	0.075	-0.283	0.066	0.153	0.031
E14	1.022	0.210	0.258	0.085	0.114	0.025
E17	0.682	0.079	-1.828	0.225	0.161	0.053
E20	0.684	0.122	2.448	0.460	0.131	0.013
E23M	0.355	0.054	1.755	0.270	0.179	0.013
E26M	0.566	0.061	0.822	0.097	0.141	0.014
E29	0.542	0.091	0.901	0.163	0.142	0.022
E32	0.500	0.083	-0.571	0.107	0.164	0.034
E35	0.491	0.118	2.590	0.631	0.126	0.016
E38	0.431	0.085	0.964	0.200	0.188	0.022
E41	0.398	0.101	2.652	0.682	0.192	[illegible].017
E44	0.444	0.116	3.071	0.814	0.135	[illegible].016
M2	0.439	0.060	-1.623	0.228	0.173	0.036
M5	0.525	0.070	0.726	0.107	0.157	0.018
M8	0.515	0.065	-0.894	0.121	0.165	0.030
M11	0.533	0.069	-0.043	0.042	0.163	0.[illegible]23
M14	0.332	0.065	2.478	0.494	0.165	0.015
M17	0.345	0.072	-4.783	1.013	0.183	0.068
M20D	0.6[illegible]	0.050	0.282	0.040	0.155	0.016
M29	0.[illegible]	0.099	0.397	0.076	0.207	0.019
M32D	0.9[illegible]	0.063	0.833	0.070	0.152	0.012
M35D	0.608	0.047	1.209	0.102	0.135	0.013
M38	0.670	0.078	1.124	0.141	0.141	0.015
M41D	0.684	0.048	0.786	0.066	0.127	0.014
M44	0.561	0.079	0.439	0.076	0.167	0.020
D2	0.540	0.054	0.973	0.111	0.152	0.022
D5	0.442	0.055	1.696	0.220	0.160	0.019
D8	0.586	0.069	-0.239	0.058	0.159	0.032
D11	0.598	0.080	-0.198	0.057	0.167	0.031
D14	0.505	0.058	-0.936	0.120	0.158	0.040
D17	0.4[illegible]6	0.065	-2.519	0.401	0.173	0.056
D23	0.739	0.095	-0.044	0.055	0.161	0.030
D26	0.426	0.059	2.466	0.348	0.164	0.017
D29	0.685	0.067	0.906	0.107	0.155	0.021
D38	0.555	0.059	1.096	0.130	0.169	0.021
D44	0.775	0.065	1.079	0.112	0.150	0.020

Higher Level Thinking Subtest (37 items)

Item	Slope	s.e.	Threshold	s.e.	Asymptote	s.e.
E3	1.342	0.223	-0.269	0.088	0.138	0.030
E6M	0.458	0.054	0.911	0.114	0.231	0.014
E9M	0.428	0.070	2.948	0.491	0.197	0.010
E12	0.571	0.083	0.112	0.055	0.171	0.027
E15	0.525	0.096	1.339	0.256	0.217	0.020
E18	0.636	0.092	-0.216	0.063	0.175	0.030
E21M	0.468	0.102	3.786	0.839	0.118	0.009
E24	0.431	0.108	2.836	0.723	0.198	0.017
E27	0.490	0.070	-0.731	0.117	0.185	0.035
E30	0.552	0.095	1.465	0.263	0.188	0.019
E33	0.702	0.108	1.228	0.205	0.170	0.019
E36M	0.537	0.048	-0.707	0.071	0.189	0.023
E39	0.506	0.106	2.351	0.505	0.178	0.017
E42	0.990	0.128	0.798	0.128	0.132	0.020
E45	0.585	0.097	1.417	0.248	0.156	0.020
M3	0.782	0.084	-0.471	0.069	0.184	0.026
M12D	1.316	0.141	-0.105	0.047	0.161	0.018
M15	0.609	0.078	1.781	0.240	0.205	0.013
M18	0.737	0.077	-0.194	0.049	0.168	0.023
M24	0.482	0.074	2.075	0.326	0.207	0.014
M27	0.613	0.075	1.291	0.172	0.225	0.016
M30D	0.455	0.043	1.402	0. 40	0.200	0.013
M33	0.614	0.102	2.982	0.512	0.115	0.011
M39D	1.072	0.053	1.492	0.094	0.095	0.009
M42	0.945	0.111	-0.084	0.053	0.175	0.022
M45D	0.512	0.068	3.145	0.433	0.246	0.010
O3	0.569	0.066	0.938	0.124	0.191	0.023
O6	0.327	0.051	1.050	0.172	0.218	0.025
O9	1.068	0.084	1.194	0.121	0.135	0.018
O15	0.791	0.069	1.142	0.124	0.183	0.020
O18	0.603	0.070	1.211	0.155	0.198	0.021
O21	0.432	0.097	4.202	0.958	0.147	0.014
O24	0.541	0.055	1.094	0.125	0.167	0.022
O27	0.644	0.070	0.722	0.097	0.186	0.023
O33	0.701	0.065	2.071	0.212	0.158	0.016
O36	[illegible].957	0.118	0.525	0.091	0.176	0.024
O42	[illegible].862	0.065	1.839	0.162	0.110	0.015

* $p < .05$
** $p < .01$

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